# GROUND BREAKING CEREMONY

FRIDAY, 6 DECEMBER 1974

PUBLIC AFFAIRS OFFICE
NATIONAL NAVAL MEDICAL CENTER
BETHESDA, MARYLAND 20014
TEL: 295-1045, AFTER HOURS: 295-0237
AREA CODE 202

OFFICIAL U.S. NAVY NEWS RELEASE
FOR IMMEDIATE RELEASE
NNMC NO. 63-74
NOVEMBER 25, 1974

GROUND TO BE BROKEN FOR NAVY ENVIRONMENTAL HEALTH EFFECTS LABORATORY

The Naval Medical Research and Development Command (NMRDC) will hold ground breaking ceremonies for the new Environmental Health Effects Laboratory at 9:30 a.m., Friday, December 6, 1974.

This facility, to be utilized by the Naval Medical Research Institute and the Navy Toxicology Unit, will comprise the major deep-diving research facility of the Navy Bureau of Medicine and Surgery. Located on the grounds of the National Naval Medical Center, Bethesda, Maryland, the laboratory is expected to be completed in November, 1976.

The new laboratory will afford a modern and extensive chamber complex and associated laboratories for biomedical research on diving problems at pressures equivalent to 3,300 feet. The staff will specialize in the physiological, behavioral and toxicological aspects of extended saturation

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News Release

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NAVAL MEDICAL RESEARCH INSTITUTE
NATIONAL NAVAL MEDICAL CENTER
BETHESDA, MARYLAND - 20014

NMRI NOTICE 5750
NMRI-OLO-mr
25 November 1974

NMRI NOTICE 5750

From: Commanding Officer
To: Distribution List "A"

Subj: Ground Breaking Ceremony for the Naval Environmental Health Effects Laboratory; promulgation of

1. Purpose. To announce the forthcoming ground breaking ceremony for the Naval Environmental Health Effects Laboratory on Friday, 6 December 1974 at 0930.

2. Background. The Naval Environmental Health Effects Laboratory will comprise the major deep diving research facility of the Navy Bureau of Medicine and Surgery. When completed in November 1976, it will afford a modern and extensive chamber complex and associated laboratories for biomedical research on diving problems at pressures equivalent to sea depths reaching 3300 feet, with specialization in the physiological, behavioral, and toxicological aspects of extended saturation diving at great depths.

3. The Ground Breaking ceremony will be held in the NMRI auditorium, and at the construction site. Due to the limited amount of seating in the auditorium only those NMRI personnel receiving invitations will be admitted to the NMRI auditorium.

4. All Department Heads/Division Officers are requested to ensure that their respective spaces present a respectable appearance.

5. Due to the limited amount of parking in the front of NMRI, NO parking will be authorized for NMRI personnel on this date. Preparations should be made in advance to utilize the parking spaces in 'E: Lot and "K" Lot.

6. The coordinator for the Ground Breaking Ceremony is Ensign P. BOVASSO, MSC, USN, Administrative Assistant to the Administrative Officer; and all questions pertaining to the ceremony should be addressed to him.

7. Cancellation. This notice is cancelled upon completion of the subject ceremony and for record purposes on 15 December 1974.

K. W. SELL

diving at great depths where cold and high pressure produce great risk.

"We anticipate that the fundamental and applied research to be performed in the Environmental Health Effects Laboratory, largely with animal models, will provide information of prime value to operations over the next two decades in all the Armed Services, and to the broad sector of the world economy involved in tapping the resources of the seabed," Captain Charles Brodine, Commanding Officer of NMRDC, explained.

The Environmental Health Effects Laboratory was designed by Sanders and Thomas, Inc., and is being constructed by Edward M. Crough, General Contractor.

-nnnc-

RELEASED T.P. Browne
T.P. BROWNE, ENS MSC USNR
PUBLIC AFFAIRS OFFICER

NAVAL MEDICAL RESEARCH INSTITUTE
NATIONAL NAVAL MEDICAL CENTER
BETHESDA, MARYLAND - 20014

NMRINOTE 5750
NMRI-013-mr
25 November 1974

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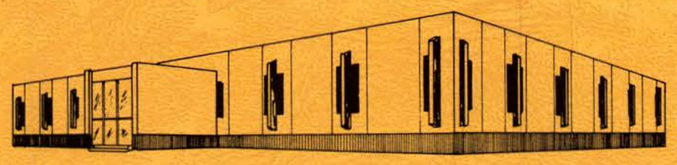
K. W. SELL

# GROUND BREAKING PROGRAM



NAVAL ENVIRONMENTAL
HEALTH EFFECTS LABORATORY

NAVAL MEDICAL RESEARCH INSTITUTE
NATIONAL NAVAL MEDICAL CENTER
BETHESDA, MARYLAND

DECEMBER 1974

Friday, Dec. 6, 1974

RADM. R.G. WILLIAMS, JR. M C USN
COMMANDING OFFICER
NATIONAL NAVAL MEDICAL CENTER
BETHESDA, MARYLAND

CAPT. C.E. BRODINE MC USN
COMMANDING OFFICER
NAVAL MEDICAL R&D COMMAND
BETHESDA, MARYLAND

CAPT K.W. SELL MC USN
COMMANDING OFFICER
NAVAL MEDICAL
RESEARCH INSTITUTE
BETHESDA , MARYLAND

The Navy Environmental Health Effects Laboratory will comprise the major deep-diving research facility of the Navy Bureau of Medicine and Surgery. When completed in November 1976, it will afford a modern and extensive chamber complex and associated laboratories for biomedical research on diving problems at pressures equivalent to sea depths reaching 3300 feet, with specialization in the physiological, behavioral, and toxicological aspects of extended saturation diving at great depths.

It is anticipated that the fundamental and applied research to be performed in the Laboratory, largely with animal models, will provide information of prime value to operations over the next two decades in all the Armed Services, and to the broad sector of the world economy involved in tapping the resources of the seabed. Accordingly, the facility is expected to attract worldwide attention, and to be a focus of jointly sponsored and executed research involving many Federal executive agencies and additional investigators from the academic and industrial echelons of society.

RADM. R.G. WILLIAMS, JR. M C USN
COMMANDING OFFICER
NATIONAL NAVAL MEDICAL CENTER
BETHESDA, MARYLAND

CAPT. C.E. BRODINE MC USN
COMMANDING OFFICER
NAVAL MEDICAL R&D COMMAND
BETHESDA, MARYLAND

CAPT K.W. SELL MC USN
COMMANDING OFFICER
NAVAL MEDICAL
RESEARCH INSTITUTE
BETHESDA , MARYLAND

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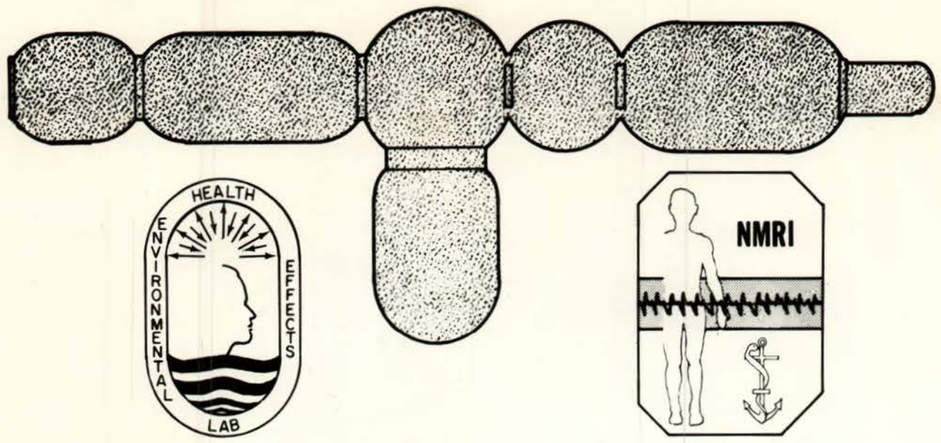
|---|---|
| INTRODUCTION AND ACKNOWLEDGEMENTS | CDR M. L. FITTS MSC USN |
| INVOCATION | LT T. C. MARSDEN CHC USN |
| REMARKS | |
| RADM R. G. WILLIAMS JR., MC USN | COMMANDING OFFICER NAT NAV MED CTR |
| HONORABLE J. GLENN BEALL, JR. | U.S. SENATOR MARYLAND |
| HONORABLE GILBERT GUDE | U.S. REPRESENTATIVE MARYLAND |
| CAPT BROUSSOULE | FRENCH MINISTRY OF DEFENSE |
| PETER B. BENNETT, M. D. | PRESIDENT PRO TEM OF UNDERSEA MEDICAL SOCIETY |
| CAPT C. E. BRODINE, MC USN | COMMANDING OFFICER NAVAL MEDICAL R&D COMMAND |

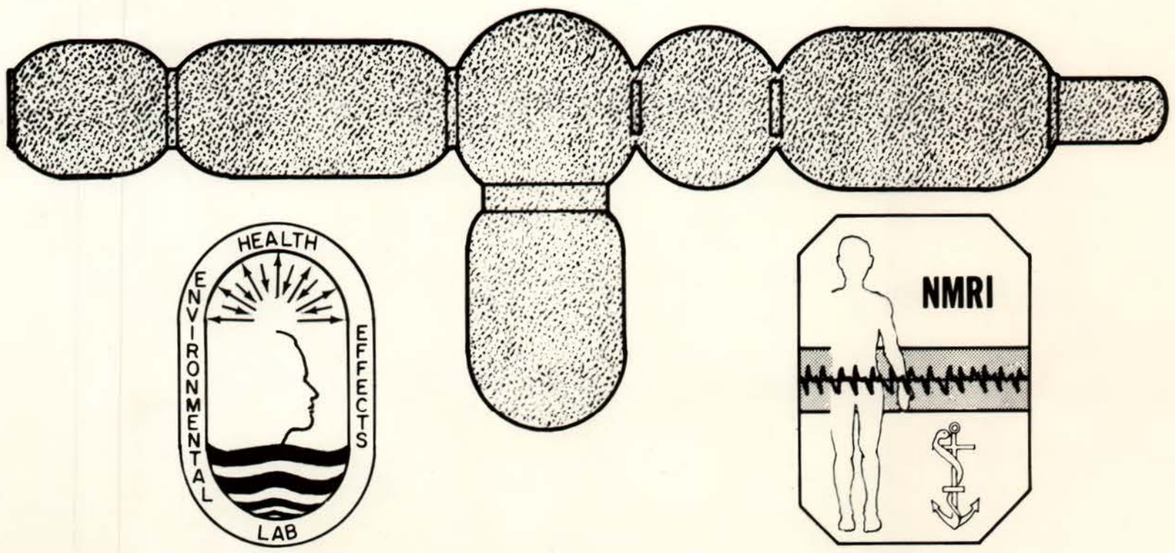



# NAVAL MEDICAL RESEARCH INSTITUTE
# BETHESDA, MARYLAND

*In commemoration of the ground breaking of the*

*Environmental Health Effects Laboratory*

*December 6th, 1974*



NAVAL MEDICAL RESEARCH INSTITUTE
NATIONAL NAVAL MEDICAL CENTER
BETHESDA, MARYLAND - 20014

NMRI-13-mw
11013
Ser: 14383
21 November 1974

From: Administrative Assistant
To: HMCS Gerald H. MOUER, 567-46-3548, USN

Subj: Escorts for Ground-Breaking Ceremony of the Environmental Health Effects Laboratory; nomination of

1. You are hereby nominated as the Senior Member of the Escort Staff for the Ground-Breaking of the new EHEL Building at 0930, 6 December 1974.

2. You will be assisted by the following personnel:

HMC Robert COLLINS, 191-34-4286, USN
HM2 James O'DONNELL, 526-88-8095, USN
HM2 Joseph J. PROCAR, 192-40-4897, USN
DT2 Bruce BRADBERRY, 421-64-5133, USN
HM2 Michael MOYER, 239-88-1378, USN
HM3 James A. GOMEZ, 467-88-6793, USN
HM3 Carl E. PARRISH, 247-06-3664, USN
HM3 Robert WILLIAMS, 553-92-2346, USN
HN Paul F. LONG, 417-60-7206, USN

3. The uniform for Friday, 6 December 1974 will be Service Dress Blue with Ribbons and Name Tags.

4. As Senior Member, you will be responsible for ensuring that all the personnel concerned are mustered prior to 0930 on 6 December 1974; and that they present a smart military appearance.

5. Your specific duties will be to escort V.I.P's and other invited guests from the main entrance of the Institute to the NMRI Auditorium, and to seat them in designated areas.

6. You are requested to establish liaison with the Administrative Assistant by 29 November 1974 for further details.

P. BOVASSO
ENS MSC USN
Administrative Assistant

Copy to:
Personnel concerned


RADM R. G. WILLIAMS, JR.
Commanding Officer, NNMC

HONORABLE GILBERT GUDE
U.S. REPRESENTATIVE OF MARYLAND


CAPT C. E. BRODINE, MC, USN
Commanding Officer, NMR&DC

HONORABLE GILBERT GUDE and
DR S. L. FRIESS

Left To Right
RADM C. L. Waite, MC, USN; CDR M. L. Fitts, MSC, USN; CAPT J. D. Cagle, DC USN; Honorable Gilbert Gude

Honorable Gilbert Gude
RADM C. L. Waite, MC, USN


GROUND BREAKING
CEREMONY

RADM R. G. Williams, Jr. MC, USN
VADM W. J. Moran, USN
Honorable H. T. Marcy

Left to Right
CAPT R. G. Ireland, MC, USN
CAPT C. E. Pruett, MC, USN, Ret.
CAPT W. Swanson, MSC, USN, Ret.

# NMRI breaks ground for new environmental lab

The Naval Medical Research and Development Command (NMRDC) held ground breaking ceremonies for the new Environmental Health Effects Laboratory Dec. 6.

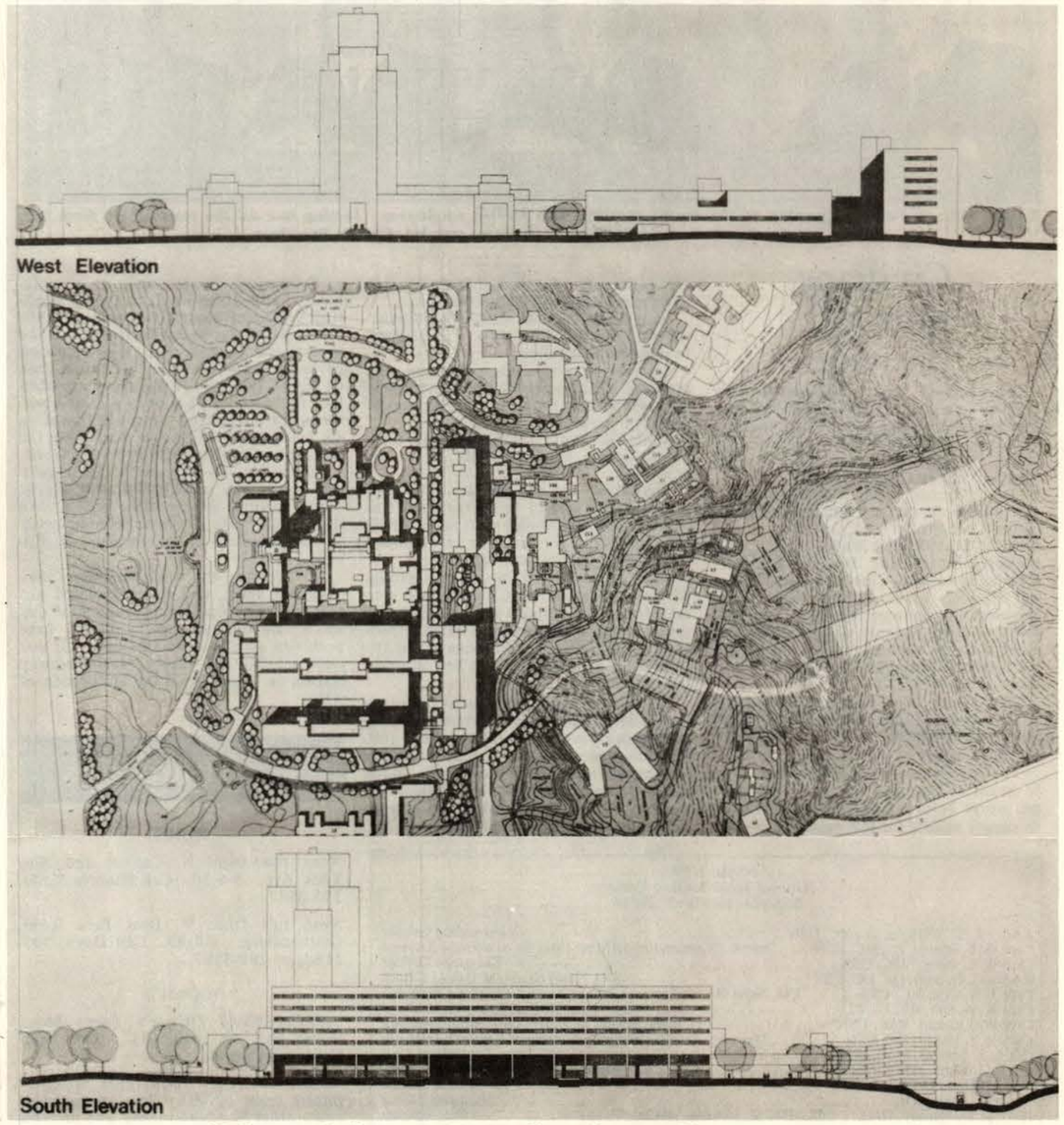
This facility, to be utilized by NMRI and NTU, will comprise the major deep-diving research facility of the Bureau of Medicine and Surgery. Located adjacent to NMRI at the site of old Bldg. 140, the laboratory is expected to be completed in November, 1976.

The new laboratory affords a modern and extensive chamber complex and associated laboratories for biomedical research on diving problems at pressures equivalent to 3,300 feet. The staff will specialize in the physiological, behavioral and toxicological aspects of extended saturation diving at great depths where cold and high pressure produce great risk.

"We anticipate that the fundamental and applied research to be performed in the Environmental Health Effects Laboratory, largely with animal models, will provide information of prime value to operations over the next two decades in all the Armed Forces, and to the broad sector of the world economy involved in tapping the resources of the seabed," Captain Charles Brodine, Commanding Officer of NMRDC, explained.

NNMC NEWS
December 1974

NNMC NEWS
Vol. 31, No. 1 National Naval Medical Center, Bethesda, Md. January, 1975



West Elevation

South Elevation

## The Shape of the Future...

-page 3

## NAVY ENVIRONMENTAL HEALTH EFFECTS LABORATORY

Groundbreaking ceremonies for the Navy Environmental Health Effects Laboratory were held at the National Naval Medical Center (NNMC), Bethesda, Md., on 6 Dec 1974. A part of the Naval Medical Research and Development Command (NMRDC), the new laboratory is expected to be ready for use by Nov 1976.

As the major deep-diving research facility of the Navy Bureau of Medicine and Surgery, the new laboratory will be used by the Naval Medical Research Institute and the Navy Toxicology Unit. It will include a modern, extensive chamber complex, and associated laboratories for biomedical research on diving problems at pressures equivalent to 3,300 feet. The laboratory staff will specialize in the study of physiologic, behavioral, and toxicologic aspects of extended saturation diving at great depths, where cold temperature and high pressure present significant risk.

"We anticipate that the fundamental and applied research to be performed in the Environmental Health Effects Laboratory, largely with animal models, will provide information of prime value to operations over the next 2 decades in all the armed services, and to the broad sector of the world economy involved in tapping the resources of the seabed," explained CAPT Charles Brodine, MC, USN, CO, NMRDC.

The Environmental Health Effects Laboratory was designed by Sanders and Thomas, Inc., and is being constructed by Edward M. Crough, General Contractor. — PAO, NNMC, Bethesda, Md.

UNDER CONSTRUCTION.—The Navy Environmental Health Effects Laboratory, shown here in an artist's conception, is now being constructed at the NNMC Bethesda, Md.

Jan. 1975 U.S. Navy Medicine

U. S. NAVY MEDICINE
January 1975

GROUND BREAKING CEREMONY AT NMRI NMRI - Feb.1975

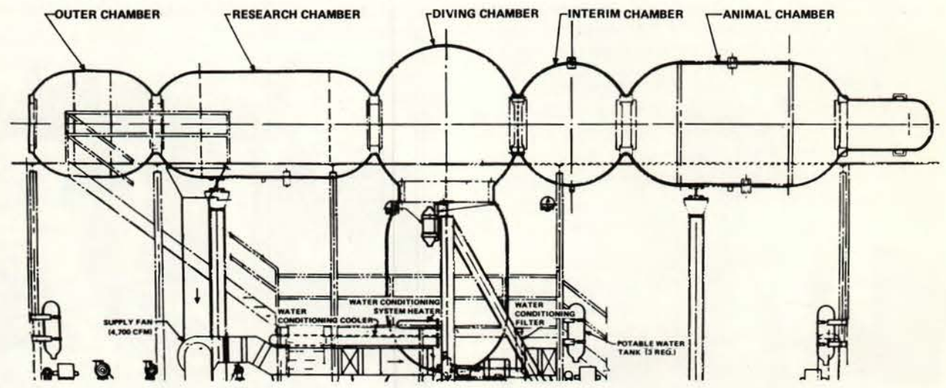
A ground breaking ceremony for the Naval Environmental Health Effects Laboratory (EHEL) was held at NMRI on 6 December 1974. Many distinguished guests attended the ceremony and participated in the ground breaking. Invited speakers were eloquent in their approval of this new facility. Among those who participated in the ceremony were: RADM R. G. Williams, Jr., Commanding Officer, National Naval Medical Center, Honorable J. Glenn Beall, Jr., Senator from Maryland, Honorable Gilbert Gude, U.S. Representative of Maryland, Peter B. Bennett, M.D., President-elect of the Undersea Medical Society, Captain C. E. Brodine, MC, USN, Commanding Officer of the Naval Medical Research and Development Command, Vice Admiral W. J. Moran, Director, Research and Development Testing and Evaluation Command, Navy Department, The Honorable H. T. Marcy, Assistant Secretary of the Navy for Research and Development, RADM C. L. Waite, MC, USN, Bureau of Medicine and Surgery, Captain W. E. Marquardt, Civil Engineer Corps, Chesapeake Division, Naval Facilities Engineering Command and Captain Broussoule, French Ministry of Defense. Invocation was delivered by LT T. C. Marsden, Chaplain, U.S. Navy. Introductions and acknowledgements were made by CDR M. L. Fitts, MSC, USN. Refreshments were served in the auditorium after the ground breaking.

NMRI
February 1975

New Hyperbaric System Under Development

# E-H-E-L Spells "Research" at NMRI

LT Don Chandler, MSC, USN
L. "Chips" Hurley, MDV (Ret.)
*Naval Medical Research Institute*




*Shown above is an artist's rendition of the hyperbaric complex that will be a major component of the Environmental Health Effects Laboratory (EHEL) at the Naval Medical Research Institute in Bethesda, Maryland. The five chambers will be located in the basement of a two-story building, with the "wet-pot" area of the diving chamber below the main structure in the subbasement. Each of the five chambers will be constructed to handle a specific area of research. Laboratories, office space, and work areas will be located on the floor above the complex. The facility is scheduled for completion by mid-1977.*



FACE PLATE
Spring 1975

## NAVY ENVIRONMENTAL HEALTH EFFECTS LABORATORY

Groundbreaking ceremonies for the Navy Environmental Health Effects Laboratory were held at the National Naval Medical Center (NNMC), Bethesda, Md., on 6 Dec 1974. A part of the Naval Medical Research and Development Command (NMRDC), the new laboratory is expected to be ready for use by Nov 1976.

As the major deep-diving research facility of the Navy Bureau of Medicine and Surgery, the new laboratory will be used by the Naval Medical Research Institute and the Navy Toxicology Unit. It will include a modern, extensive chamber complex, and associated

and diving operations commenced using the KMB-8 under the supervision of HTCS(MDV) Ortiz and ENS D.S. Hunt, the ship's Salvage Officer. The first significant piece of wreckage, the outer port wing section, was raised on a wire sling attached by LTjg R.C. Gillis. The first injury of the operation occurred later that afternoon, when ENS R.E. Simpson cut his right knee on jagged debris on the bottom and had to be hospitalized for 2 days.

For the next 6 days, divers wearing SCUBA dove on the primary wreckage site and brought up wreckage using the aforementioned wire sling for large fragments and a submerged hatch basket for smaller debris. Recovered debris was identified by USMC representatives and taken ashore by boat, where it was assembled into a mock-up by investigators. Bottom visibility was poor throughout the diving phase, and divers also complained of stinging from aircraft fuel present in the water. Weather throughout the operation was excellent with the exception of winds that occasionally shifted SAFEGUARD off of her station. Jagged wreckage continued to be a hazard, and BM3 Larry Crawford was also sidelined after cutting his knee during a dive. By twilight on November 2, the determined SAFEGUARD divers had recovered 90 percent of the wreckage, including the entire port and starboard engines and cockpit wiring sought by USMC investigators. Credit for the speedy completion of this part of the operation goes to the following SAFEGUARD divers: SN Tim Adelsberger, BMSN Frank Costa, QM3 Eugene Hartman, HT3 Bill Huston, HTFN Jeff Krouse, ENFN Bill Maddick, MM1 Dave Glaser, ENS A.H. Rose, and HMC Wykoff.

On November 3, General Electric technical representatives, Mr. Bowen and Mr. Lachappelle, arrived on board SAFEGUARD to assist the salvage divers in identifying those missing pieces still desired by the investigators. Specifically, these pieces were the two fuel pump gearboxes on the starboard engine. At this point, the contribution of the three AJAX divers, BM2 Johnston, MM2 Sherman, and BM3 Barber, and one SAFEGUARD diver, HTC(DV) J. Searcy, played a vital role in the recovery. Their performance throughout the diving operation was outstanding, but on the final day of diving they exhibited an uncanny ability to go to the bottom in limited visibility and bring back exactly those fragments sought by the technical representatives. With the recovery of the gearboxes, the technical representatives decided that no additional wreckage was required for the investigation of the crash. Salvage operations were then secured; and on November 4, SAFEGUARD moved into port at MCAS Iwakuni for a well-deserved liberty for all hands.

Left: Starboard engine is transferred to waiting LCM-6 boat for transport to shore. Right: Members of SAFEGUARD's salvage crew on fantail. Included in photo are BM2 Crehan, HTCS(MDV) Ortiz, SN(DV) Adelsburger, ENFN(DV) Maddick, HTC(DV) Searcy, QM3(DV) Hartman, BM3(DV) Crawford, BM2(DV) Johnston, CWO-2 Petchesky, Major Sites (USMC), and HTFN(DV) Krouse.



Society, Captain G. E. [illegible], Medical Research and Development Command, Vice Admiral W. J. Moran, Director, Research and Development Testing and Evaluation Command, Navy Department, The Honorable H. T. Marcy, Assistant Secretary of the Navy for Research and Development, RADM C. L. Waite, MC, USN, Bureau of Medicine and Surgery, Captain W. E. Marquardt, Civil Engineer Corps, Chesapeake Division, Naval Facilities Engineering Command and Captain Broussoule, French Ministry of Defense. Invocation was delivered by LT T. C. Marsden, Chaplain, U.S. Navy. Introductions and acknowledgements were made by CDR M. L. Fitts, MSC, USN. Refreshments were served in the auditorium after the ground breaking.

NMRI
February 1975

The mention of Navy medical research causes most nonresearch people to form a mental picture of a test-tube-filled laboratory with a bespectacled individual in a white coat perched on a stool, peering intently into a microscope. To a Navy researcher, however, Navy medical research usually creates a mental picture of a diver submerged in the depths of the ocean; or a lonely figure in the cold Antarctic, with eyes squinting from under the hood of a fur-lined parka; or even a perspiring khaki-clad individual deep in the equatorial plains of Africa. Extreme? Possibly. All these illustrations, however, are represented in the broad spectrum of medical research that the Navy relentlessly pursues.

Fortunately, not all Navy research is conducted in remote, and often hostile, parts of the earth. Likewise, not all diving medical research is conducted in the depths of the ocean. Much of the basic diving medical research, in fact, is conducted at geographic locations far removed from the ocean. For example, inland, approximately 60 miles up the Potomac River, bordering the northwest corner of Washington, D.C., is Bethesda, Maryland. The Naval Medical Research Institute (NMRI), where 90 percent of all basic diving medical research is conducted, is located there as a tenant activity to the National Naval Medical Center.

Why would the Navy want to conduct diving medical research so far removed from the ocean? Why, also, would the Navy prefer a location not conducive to comfortable year-round diving? The answer to these and many similar questions is obvious when one considers that Washington, D.C., and its environs has a world-renowned scientific community. Within 1 hour from Bethesda there are 49 research-related facilities, ranging from biomedical to academic to marine oceanographic activities.

Because of the accessibility to this scientific community, the Navy selected NMRI as the site to construct a new diving research facility sponsored by the U.S. Navy Bureau of Medicine and Surgery. The name by which the facility is currently identified is the Environmental Health Effects Laboratory (EHEL).

The EHEL, which will be located in a two-story building, will be approximately 280 feet by 100 feet, and will provide an overall area of 60,000 square feet. Because of the weight and size of the hyperbaric system to be installed, and to achieve maximum accessibility in terms of conducting and monitoring research experiments, the chamber complex will be located in the basement and subbasement of the building. The floor space above the chamber will house supporting laboratories, offices, and work areas.

The hyperbaric complex will consist of five HY-80 steel pressure vessels totaling 3,630 standard cubic feet (surface). All five vessels will be equipped with receiving ports, service locks for food and supplies, feed-through connections for monitoring instruments, and communication penetrations. Each of the five pressure vessels will be fabricated for different purposes: An outer chamber to be used for "lock-in/lock-out" access; a research chamber, where most of the dry environment monitoring will be conducted; a diving chamber, part of which will be used as a "wet-pot" for in-water research; an interim chamber that will be used as an inside lock and access to the animal chamber; and the animal chamber, which will be used primarily for animal research. The diving chamber (wet-pot) will be equipped to maintain any water temperature between 28°F and 85°F.

Specifically, the EHEL staff will be concerned with research on the physiological, psychophysiological, and toxicological effects experienced in underwater depths to 3,350 feet of seawater as well as in all closed systems environments. The unique nature of the work to be conducted requires that the total system be man-rated and, therefore, supported with sophisticated subsystems.

These subsystems will include a controlled atmosphere system for heating, cooling, filtering, and $CO_2$ removal; a contaminate injection system for controlled experimentation; a sensing and control system for monitoring and controlling the hyperbaric atmosphere; a data recording system for on-line monitoring and data storage; and a helium reclaim system.

In addition to the man-rated complex, there will be a battery of 57 animal chamber units, each unit consisting of two interconnected but separate chambers. These small animal chambers will be used by the Navy Toxicology Unit for their basic research programs.

The new facility is scheduled for completion by mid-1977. Optimally, when completed, the EHEL will be staffed by both military and civilian employees. When it is operational, the EHEL will be one of the most sophisticated hyperbaric systems in the world that is totally dedicated to the basic research necessary to extend man's time and depth mobility beneath the oceans.

**Sophisticated System**

# Hyperbaric Chamber Being Built

BETHESDA, MD.—A sophisticated hyperbaric chamber that ultimately is expected to attract worldwide scientific interest is now being built at the National Naval Medical Center here.

The chamber, to be surrounded by laboratories and other test equipment, will be used to study the physiological effect a deep ocean environment has on man and hopefully help him cope better with it.

Called the Environmental Health Effects Laboratory, the new unit eventually will have a staff of about 15 scientists, both military and civilian, and 100 support personnel.

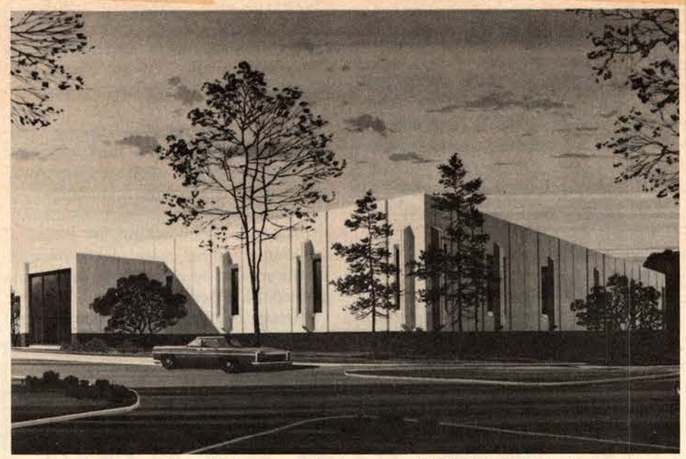
It will be the "most sophisticated hyperbaric system in the world that is totally dedicated to basic research, according to project officer Lt. Donald R. Chandler, MSC, USN.

"The more work we do in the sea, the more important it becomes," Lt. Chandler said. The ultimate benefit, as far as the Navy is concerned, will be in salvage, operations, he said. But the laboratory may also answer questions that have been plaguing deep sea work.

One question to be answered is how deep man can safely go.

Another is to find an improved mixture of gases that can be used at depths below 1,600 feet.

The laboratory itself will be capable of simulating depths up to 3,350 feet, but Lt. Chandler said man probably will not be taken below 3,300 feet. At that depth it will take 30 days just to bring the diver "back up"—a slow process because of the dangers of decompression sickness.



**Artist's conception of the new Environmental Health Effects Laboratory**

The laboratory also will have chambers for hyperbaric research on animals.

At present, Lt. Chandler said, a diver is severely handicapped in the amount of things he can accomplish at 1,600 feet. Most work now done below this level is in chambers, or bells.

Scientists at the laboratory will try, among other things, to find an improved mixture of gases for the divers to breathe. The present helium-oxygen combination is not light enough for great depths.

There is experimentation taking place with neon, nitrogen, oxygen and helium and even hydrogen, Lt. Chandler related. "All these mixes need to be explored," he said.

Such complications as the "helium tremors"—a severe shaking experienced at about 1,600 feet, presumably because of the helium being breathed—make productive work impossible, he said.

"Man is severely handicapped to about 50 per cent capacity" at this depth, he said.

Another complication with the he-

*(Continued on page 18)*

U. S. MEDICINE
May 1, 1975

U.S. MEDICINE

# Hyperbaric System Now Being Built Will Be Most Sophisticated

*(Continued from page 3)*

lium-oxygen mixture is that divers experience a feeling of being "starved for oxygen," even though they actually are not.

"It's like an asthma attack," Lt. Chandler said. "Just a small amount of exertion brings it on."

Such "unanswered questions" must be solved if man is "really going to use the sea," he said.

"There's been more and more interest in mining and farming the seas," he noted. "Some even say America's future depends on its use of the sea."

The animals—mice, rats, cats, dogs and monkeys—will be used to test various gas mixtures and find out what kind of toxic effects they might entail. For example, Lt. Chandler said, one thing that must be determined is the toxicity of the hydrocarbons in the mixture and of gases given off from various materials at that pressure.

"The lab will be very sophisticated," Lt. Chandler said. It will use closed circuit television monitoring to keep tabs on the divers in the chambers. The atmosphere will be closely monitored, and the divers will be "hard wired" to find out what is happening to them physiologically.

The human research subjects will be a crew of Navy divers, including some physicians. In fact, Lt. Chandler said he expects a physician to "go under" with each set of divers. Most dives will last 90 days, allowing 10 days to go under, 50 for the test and 30 for resurfacing.

The divers all will be volunteers who are qualified and experienced in deep

*—U.S. Medicine photo*

**Lt. Donald R. Chandler**

water work, Lt. Chandler said.

Although the work at the laboratory is referred to as "diving," only one of the five high-pressure chambers will actually have water in it. The "wet pot," as it is called, will be used to see what kind of tasks the men can perform under water.

The other chambers contain merely high-pressure gases pumped in to produce a pounds-per-square-inch pressure equivalent to the desired ocean depth.

Lt. Chandler said the men will be fed "routine diets" during their dives.

"There is a great need for nutrition studies in this area," he said. "We know there is noticeable weight loss at great depths. There is a deterioration of nutrition, even though the men are fed proper diets and given everything they want.

"This is one area that has never been studied adequately."

Lt. Chandler said he foresees the laboratory as a "national resource" to be used by numerous federal agencies and universities, including the new Uniformed Services University of the Health Sciences, to be built on the same campus.

Many scientists, he said, "are already here doing investigations," including some exchange scientists from Great Britain. In fact, Lt. Chandler said the laboratory already is attracting attention internationally.

The building itself will be completed in December, but the hyperbaric system will not be ready until mid-1977.

In the meantime, he said, there are many human engineering studies to be done: a wooden mockup of the hyperbaric system is being built to test out how fast the valve can be opened and closed, where the TV camera mounts should go, what color it should be painted, etc.

The laboratory is costing about $15 million to build, but at that is a scaled down version of what was originally planned. "We ran out of money," Lt. Chandler said.

It will have five connecting hyperbaric chambers in the basement and sub-basement levels. The laboratories and office spaces will occupy the upper floors. The animal chambers will be adjacent, with their own support system.

The laboratory's decompression chamber will double as a clinical facility for the Navy hospital nearby for treatment of such conditions as gangrene, tetanus, carbon monoxide poisoning and anaerobic infections, which have been shown to respond to hyperbaric treatment.

If a medical emergency occurs during a "dive," he said, the physician will have to take care of it at high pressure.

Lt. Chandler himself is qualified in deep diving and is probably the Navy's only Medical Service Corps Officer to be so.

He started out as a hospital administrator, and about 10 years ago was stationed on a submarine. There he came into contact with hyperbaric environments and became fascinated by them.

He then took some courses at George Washington University, and when an opening came up at the experimental diving unit at the old Navy Yard in Washington, he was named administrative officer.

He helped set up the Navy Yard replacement unit at Panama City, Fla., and then was detailed to head the Bethesda project.



*—U.S. Medicine photo*

**New health effects laboratory rises on Naval Center grounds**

U. S. MEDICINE
May 1, 1975

E H E L
MRCC - FIRST HY-80 TRIMMINGS

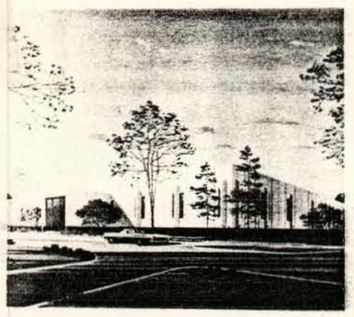
# NNMC NEWS

Vol. 32, No. 3 National Naval Medical Center, Bethesda, Md. April 9, 1976


tigating the physiological impact of diving environments since 1942. At that time, little was known concerning the biomedical problems of the underwater milieu.

Although most of the equipment now in use was scarcely imagined 35 years ago, the dedicated personnel of the Hyperbaric Medicine and Physiology Department are still very much involved in the research of human physiology and the treatment of conditions similar to those encountered by veteran Navy divers. The NMRI diving lab is equipped with three deep pressure chambers and an open diving tank in which certified Navy divers and corpsmen test-subjects are exposed to simulated environments of varying pressure, temperature and atmospheric composition.

At any given time, as many as twelve different experiments are underway in one phase or another in the Hyperbaric



**The Hyperbaric Research Facility is currently under construction at NNMC. The new building will include expanded testing chambers for hyperbaric research.**

Medicine and Physiology Department, involving as many as ten test subjects or divers. Of course, during all testing in the laboratory, U.S. Navy diving regulations are strictly adhered to, including the use of life jackets when divers are in the open tank chamber. Safety is a prime concern to the diving lab personnel, and divers and test subjects in the various experiments are closely monitored while in the testing chambers. Routine heart-rate and temperature readings are made, and blood and urine samples are analyzed following each test to ensure the health and safety of the test subjects.

Furthermore, two-way visual and verbal communication is always maintained while a test subject is present in the chamber. The 'buddy system' is likewise applied, with no test subject ever entering an experiment alone. Using an intercom system, test subjects can converse with monitoring personnel, and in the event of a power failditions similar to those experienced by divers in stress environments.

Basic research performed by the NMRI diving lab and collaborating laboratories around the world has provided much improved methods for the treatment of hyperbaric oxygen toxicity, inert gas narcosis, gas gangrene, decompression sickness and carbon monoxide poisoning. The NMRI lab helped to pioneer the use of hyperbaric chambers in the treatment of these maladies. In 1970, the preferred treatment involved a 4-day therapy cycle. Today, with the use of the high oxygen atmosphere of the hyperbaric chamber, 90% of all narcosis and embolism cases can be treated in a maximum of 4-5 one hour treatments.

The Minimal Recompression Oxygen Therapy, once an experimental technique at NMRI, is now a mainstay of clinical treatment. Further, current experimentation into the mechanics of circulatory interuption being performed in the diving lab is showing great promise in the treatment of arterial disfunction. This basic research may one day lead to improved pharmacological means of treating decompression sickness.

The expansive research of the Hyperbaric Medicine and Physiology Department has involved collaboration with other national and international agencies. In the past both the personnel and the equipment of the diving lab have been utilized by NASA, NOAA, OSHA, the National Institutes of Health, the Bureau of Standards and the Heart and Lung Institute. The diving lab has also joined in collaborative efforts with the Defense and Civil Institute for Environmental Medicine in Toronto, the COMEX Laboratory in Marseilles, France

**Personnel of the Hyperbaric Medicine and Physiology Department are always on-hand to oversee and monitor test subjects in diving chambers.**

and the Royal Navy Physiology Laboratory of Great Britain. In fact, a joint U.S.-British exchange program has been in operation for several years. Surgeon Commander J. M. Young, a Royal Navy Science Exchange Officer, is currently performing a series of experiments at the NMRI diving lab under the auspices of this international agreement.

In the advancement of environmental stress research, the Hyperbaric Medicine and Physiology Department will be relocated in the new Hyperbaric Research Facility next year. Currently under construction, the new laboratory will be outfitted with new diving and pressure test chambers, with the capability of simulating a pressure depth of over 3,000 feet below sea level. The new testing facilities will be comprised of a technologically advanced five-stage pressure chamber, which will be the second deepest operating pressure chamber in the world.

The new chambers of the Hyperbaric Research Facility are sure to open new vistas of experimentation and research into human physiology and treatment of unique medical conditions. The Hyperbaric Medicine and Physiology Department has been making vital contributions in biomedical research since its inception, and with the expanded experimental capability, it is sure to continue in the forefront of physiological investigation.

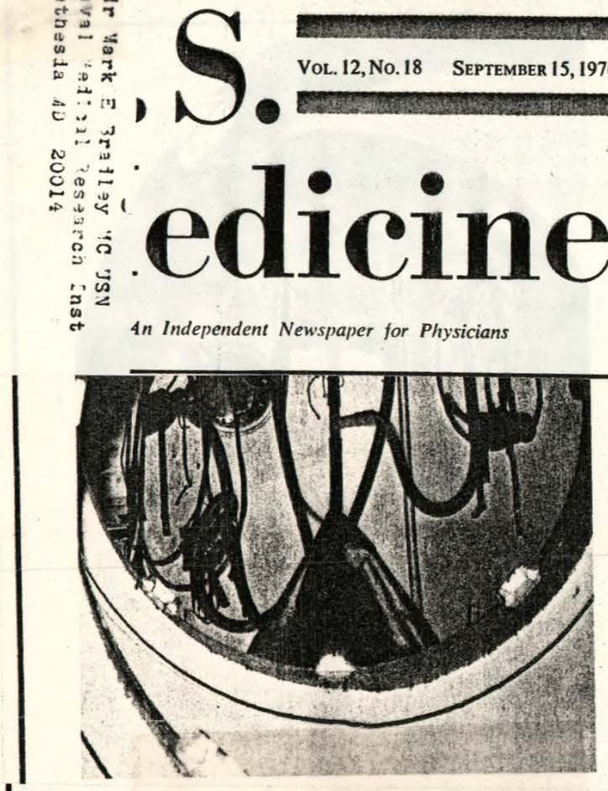
**Prior to pressurization of a testing chamber, a diving lab technician attaches monitoring devices to an experimental test subject. The chambers designed for the new Hyperbaric Research Facility will be able to accommodate pressures up to 3000 pounds per square inch.**

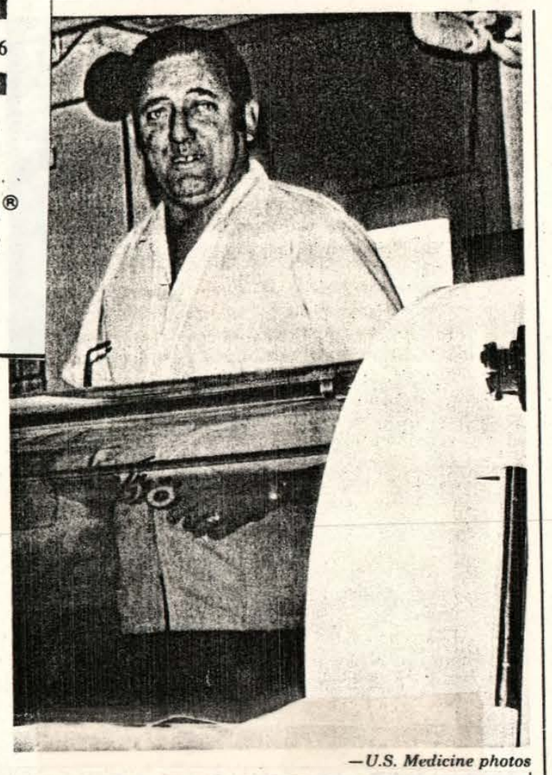
U.S. Medicine®

Vol. 12, No. 18 September 15, 1976

An Independent Newspaper for Physicians







—U.S. Medicine photos

## Navy Diving Research:

# Hyperbaric Chambers Set For Lab

(Continued from page 3)

in the coming fiscal year on medical research dealing with effects of high pressures has some clinical applications as well, however, he said.

One two-year program is looking into the "thermal problem" in diving —how to keep divers warm in the cold depths of the ocean for extended periods.

Another involves oxygen therapy for various diseases, such as gas gangrene, with the hyperbaric medicine and physiology providing all clinical treatments for the National Naval Medical Center here.

Concurrently it is studying oxygen toxicity—how to deliver the optimum dosages of oxygen without harmful effects.

Researchers also are investigating respiratory problems in diving, particularly to develop standards for breathing apparatus.

"We're also working on the changes in lung function that occur following a normal dive," Dr. Vorosmarti said, "and also the effects just of immersion in water."

Merely standing in a swimming pool compresses blood vessels in the extremities and reduces chest volume, he said.

The inert gases used for breathing underwater also are being looked at to develop a "scientific basis for decompression schedules," Dr. Vorosmarti said.

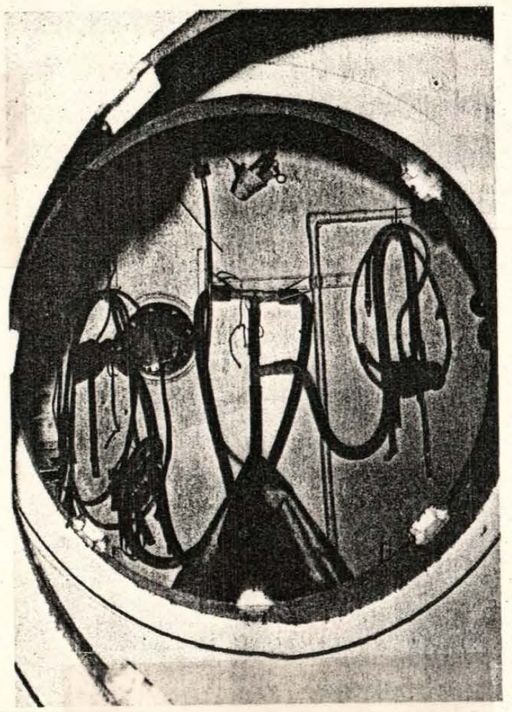
"We're also examining the changes in blood caused by different gases" (nitrogen and helium, mainly). It may be that they change the clotting mechanism, he said.

One of the biggest projects, he said, is the central nervous system pathophysiology of decompression sickness and of cerebral air embolisms.

"We're trying to improve treatment and to arrive at a basis for treatment," he said. The air embolism study is being done in cooperation with the Royal Navy's physiology laboratory at Alverstoke, England.

Another program deals with hyperbaric microbiology—changes in bacterial sensitivity to antibiotics at high pressures and what possible genetic changes might occur because of such pressures.

Behavioral scientists are studying behavior, particularly nervous syndrome at high pressure and with different methods of decompression.



—U.S. Medicine photos

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# Hyperbaric Chambers Slated For Navy Lab

BETHESDA, MD.—Navy medical researchers studying various physiological and behavioral problems associated with diving have begun moving their offices and laboratories into the medical department's new Environmental Health Effects Laboratory.

Installation of special new hyperbaric chambers is slated to begin next month.

But it will probably take as long as two years to complete installation, testing and certification of the chambers, designed to study the effects of high pressures.

"We won't be able to do human testing until about the end of 1978," Capt. James Vorosmarti Jr., MC, USN, said.

The new chambers will allow researchers to study the effects of diving as deep as 3,300 feet. The chambers currently being used go only to 1,000 feet.

Dr. Vorosmarti, deputy director of the Navy Medical Research Institute and chairman of the department of hyperbaric medicine and physiology, said construction of the new laboratory is a sign of the Navy's new emphasis on medical research into diving.

In fact, hyperbaric medicine was not a separate department until late last year.

"Engineering and technology are catching up with medical knowledge about diving under great pressures," Dr. Vorosmarti explained.

"The new emphasis hopefully will increase the gap between medical and engineering knowledge," he said. "There's no sense in working on the technology if man is unable to work at those depths."

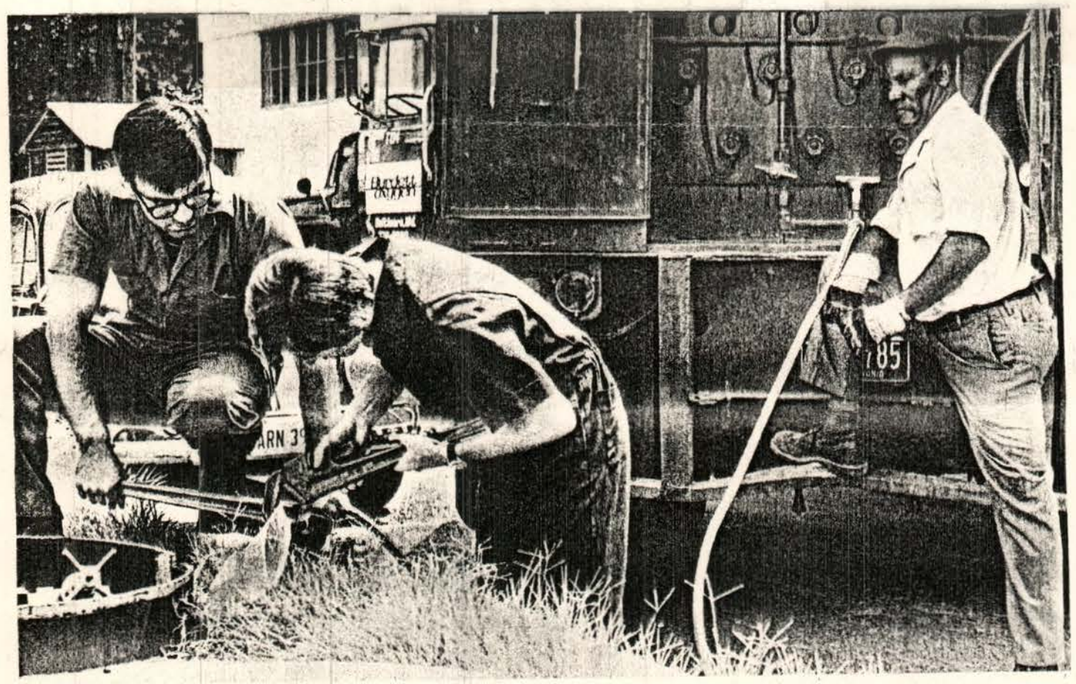
The field, he said, is a "productive area," but one in which more needs to be done.

The $3.5 million the Navy will spend

*(Continued on page 10)*

*—U.S. Medicine photos*

**Dr. Vorosmarti with one of the chambers now used to simulate dives**



**Oxygen tanks buried outside the diving area are filled**

**Dr. Vorosmarti checks supply pipes**

## VA Research

## Foreign MDs

**HAHN & CLAY**
MACHINE AND BOILER WORKS
5100 CLINTON DRIVE • HOUSTON, TEXAS 77020 • (713) 672-1671

March 14, 1977

Mr. Chips Hurley
U. S. Naval Hospital
Naval Medical Research Institute
Engineering Dept. #48
Bethesda, Maryland 20014

As I promised during my 3/10/77 visit to your interesting research institute, you should find copies of Hahn & Clay's Newsletter - The Anvil.

Each month we feature the most important, interesting or unique project.

"Our" job #99700 was the February job of the month.

Very truly yours,

HAHN & CLAY

Larry Megow
Vice President

LM/js

Enclosures

*STEEL PLATE FABRICATING*



# JOB OF THE MONTH

by
Larry Megow

99700 is a deep ocean environmental simulator. It will be shipped by truck to Bethesda, Maryland, a small town on the edge of Washington, D.C.

The simulator will be installed in a new human research laboratory at the United States Naval Hospital.

The facility will be used to simulate deep sea conditions down to 2,250 feet. At 2,250 feet, the weight of the water is 1,000 pounds per square inch.

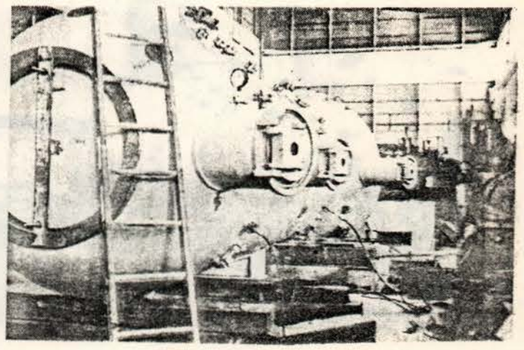


PHOTO #2 - Vessel being gas tested at 1,000 psi.

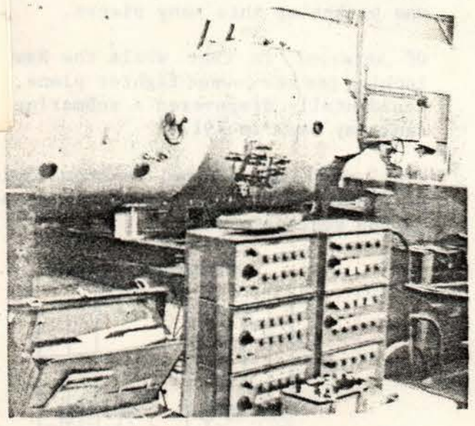


PHOTO #1 - Simulator being hydro and strain gage tested at 1,250 psi.

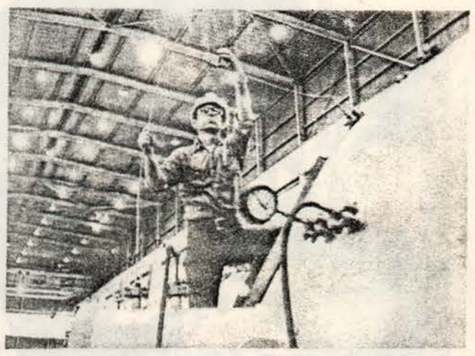


PHOTO #3 - Walt Christmas opening up a small valve to equalize the pressure in one of the (3) medical locks.

(Continued on page 4.)

The HAHN & CLAY Anvil
Houston, Texas

THE ANVIL VOL. X, NO. 2 FEBRUARY 1, 1977

# KURTZ CELEBRATES 35TH ANNIVERSARY

January 20, 1977

Mr. Leroy Kurtz
4528 Perry
Houston, Texas 77021

Dear Leroy,

Hahn & Clay wishes to award you, Leroy, something special for thirty-five (35) years of faithful service to the Company and its employees.

With this thought in mind, we feel a special, one time reward is the order of the day. Attached is an accumulation of ideas for you and Gladys to consider in celebrating this landmark in your lifetime.

Here's your opportunity to select a vacation to any part of our United States, including Hawaii, or select a cruise in the Caribbean, or visit Europe, London, Paris, Rome, etc., or Mexico and/or something in between. And in addition, to further add to your selection, the company is granting you, for this 35th Anniversary only, an extra week of vacation which you may use as part of your forthcoming plans.

It is our wish that this opportunity provides both of you with a wonderful and happy vacation - one that you will want to remember the rest of your lives.

Sincerely,

HAHN & CLAY

Henry J. Clay
Gene Clay



# JOB OF THE MONTH

by
Larry Megow

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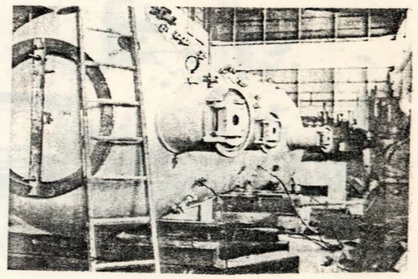

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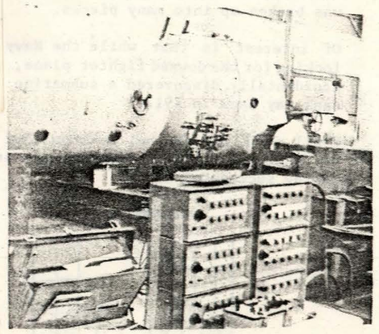

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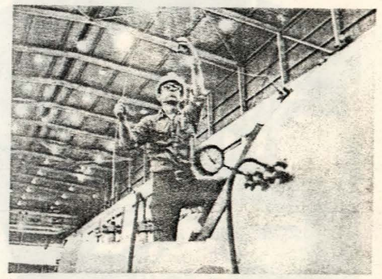

PHOTO #3 - Walt Christmas opening up a small valve to equalize the pressure in one of the (3) medical locks.

(Continued on page 4.)

## COMMENDATION

Councilman Larry McKaskle (shown with Marshall Brantley) and Mrs. McKaskle - (Mac's son and wife)- recently visited with us. They proudly let us see a very beautiful resolution signed by Mayor Fred Hofheinz, commending our Mac for his lifetime contributions to the City of Houston.

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## LIFE LINES

by

*Barbara Roth*

and

*Billie Sommer*

Retired employee, Mickey Glameyer has returned home and is doing well after having back surgery last month . . . Belated Happy Birthday wishes to Rita Moss and Marshall Brantley who both celebrated another year gone by last month . . . Our receptionist, Mary Brashier, has been away for three weeks and is home recovering after surgery on January 10th. Mary is missed by all and she hopes to return to work by the first of February . . . Joe Vitela has been off for several weeks after having nose surgery in January . . . Harry Wratten, Machine Shop, took his vacation and went to Dayton, Ohio to visit his brother and from there, drove to Indianapolis, Indiana to visit other relatives. Sounds like a pretty good vacation! . . . Roger Stevens, Blacksmith Shop, took a vacation and looks like he spent most of it trying to fix his car. Rumors are that he wasn't too successful. Sorry, Roger, better luck next time . . . Billy Kelly also took a vacation this month. We have been unable to get details yet. Maybe we'll have some for the next issue. Hope you enjoyed, Billy . . . Larry and Sylvia Megow became great grandparents for the first time on December 23rd. Their granddaughter, Mrs. Donna Hood is the mother of a 7 pound 2 ounce baby girl named Melanie . . . Roy Alaniz, Department 1, is sporting a new Pontiac these days. Sure is a beauty . . . Garland Woodard has been in St. Joseph's Hospital since January 4th with shoulder problems. At this time Garland is in traction and the doctors have considered surgery as an answer to correct the problem . . . Ike Gurka and John Robinson both took vacations this month and both spent them the same way. They just sat around the

(Continued on Page 8)



## JOB OF THE MONTH

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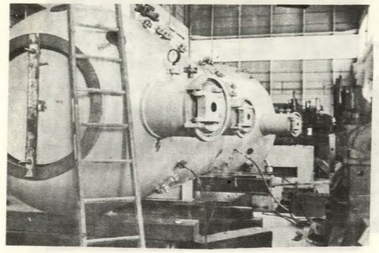

PHOTO #2 - Vessel being gas tested at 1,000 psi.

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(Continued on page 4.)

THE ANVIL PAGE 3 FEBRUARY 1, 1977

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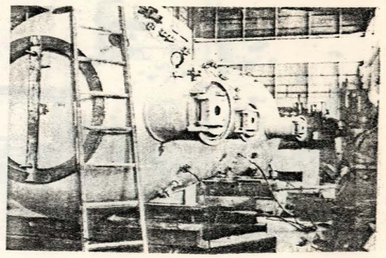

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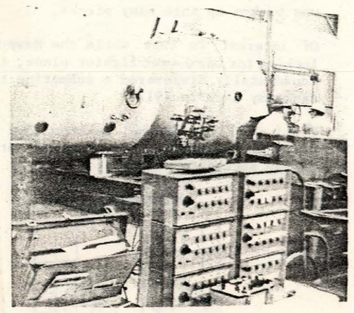

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(Continued on page 4.)

(Continued from page 3.)

# Alvin Activity

by

Larry Megow

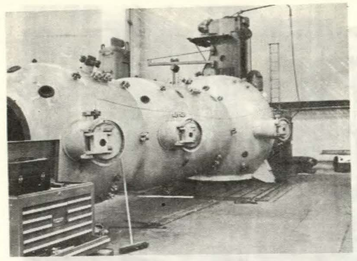


PHOTO #4 - Setting in front of the Morton for finish drilling some holes and maching a gasket seat.

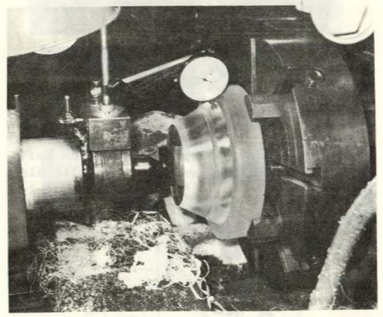


PHOTO #5 - Machining one of the plexiglass windows. It's hard to see him, but our Tom Pool is doing the machining.

We don't have room to list everyone who worked on this important project, But, Mike Tracy was the Project Coordinator.

Remember back in 1962 and 1963 we built (3) spherical hulls for the deep diving submersible called Alvin?

Alvin has made several hundred dives, many down to 6,000', and is still diving.

The other (2) hulls were put in operation in 1965 and are called the Seacliff and the Turtle. Both are being operated by the Navy diving out of San Diego, California.

In April of this year (1976), the Seacliff and Turtle participated in locating and salvaging a F-14 Tomcat Fighter plane which crashed about 23 nautical miles West-Northwest of Ensenada, California.

The F-14, located in 3,340 feet of water, was broken up into many pieces.

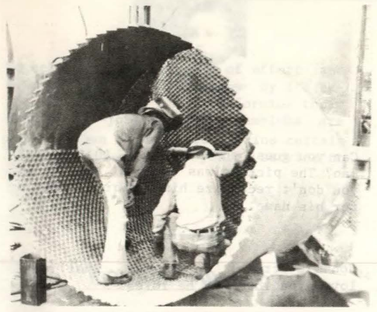
Of interest is that while the Navy was looking for the downed fighter plane, they accidentally discovered a submarine that sank way back in 1917.

Y'all will be pleased to know that the (3) hulls we built 15 years ago are still making successful dives.

**"Tell me—was it the dynamite caps I sat on to have a smoke or the can of powder I threw the cigar butt in?"**



# HAHN & CLAY AT WORK



Ike Skweres and Herman Miles are tack-welding the grating into Job #18018.

Jeff Fincher, of the Turbine Shop, is pictured above, as he is preparing to balance the first of two giant brass river pump impellers.

Jeff finished both of these in a near record setting five hours.

According to Jeff, nobody other than his knappy old team leader could have done any better ! ! !

Dennis Leassear (left) and Jack Downey precision machining (4) 10 3/16" long intregal keys 19,000" O.D. on a 4140 heat treated forging to fit inside a bore with only .002" clearance. One added requirement was that the keyways had to have a 3.2 RMS finish. Job 19187.

Calvin Anderson automatically welding the A-516-GR70 head joints on Job #N-13234.



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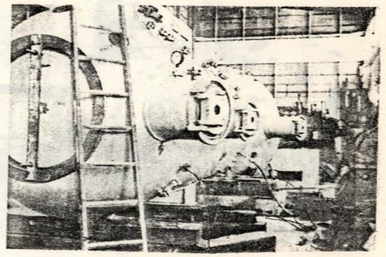

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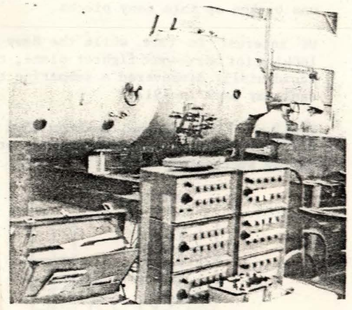

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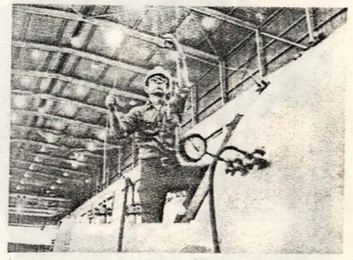


PHOTO #3 - Walt Christmas opening up a small valve to equalize the pressure in one of the (3) medical locks.

(Continued on page 4.)

## FOR YOUR INFORMATION

JOB #N-13737

N-13737 was featured as the job of the 1976 year in the January Anvil. You will all be interested to know that the two drywell sections were loaded on a barge for transporting to the jobsite in Mississippi. Hahn & Clay's surveyors,persons who inspect and approve water shipments, are Jerry Powers, Rita Moss and Gene Woodruff.

---

I'M AFRAID YOU'RE TAKING DIE-SETTING A BIT TOO LITERALLY, FRANKLIN!

## GUESS WHO?

Can you guess the name of this young man? The picture was taken at age 1. If you don't recognize him, turn to page 8 for his name.

---

Johnnie Straka: "In grammar, what is, I love, you love and he loves?"

Jessie Manley: "I don't know about grammar, but I think somebody's gonna get shot!"

---

## WELDING INSPECTORS

*Candidates for the welding inspector qualification test at Houston, Texas, listen to last minute instructions*

If you look real close you'll see Larry Chabert and George Perez along with 83 other candidates trying to pass a written test on 10/09/76 for Welding Inspector Qualification and Certification. Of course they passed.

WELDING JOURNAL



## Service Awards

To acknowledge the years of effort and dedication given our company by its respected employees while performing their individual jobs, service emblems are awarded when an employee attains certain levels of consecutive years service to Hahn & Clay.

### SERVICE AWARDS

5 Years - Sterling Silver Award

10 Years - Solid Gold Award

15 Years - One 5-point diamond added to gold award

20 Years - Second 5-point diamond added to gold award

25 Years - Third 5-point diamond added to gold award

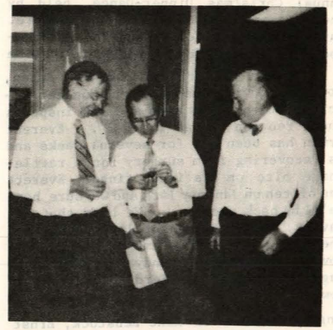
30 Years - One 10-point diamond added to center of gold award, making a total of three 5-point diamonds and one 10-point diamond.

(Awards are available as tie tack, pin or necklace.)

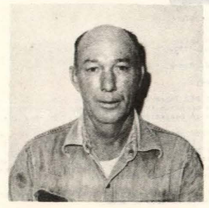
Leroy Kurtz celebrated his 35th consecutive year at Hahn & Clay on January 14, 1977.

Congratulations, Leroy.

(See story on page 1.)



Wally Urban (center) is presented his award for completing 15 years consecutive service to Hahn & Clay on Jan. 15, 1977. Shown with Wally are Gene Clay (left) and Henry Clay.



Elton Matthews received his award for ten years consecutive service on Jan.11, 1977.

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## JOB OF THE MONTH

by
Larry Megow

99700 is a deep ocean environmental simulator. It will be shipped by truck to Bethesda, Maryland, a small town on the edge of Washington, D.C.

The simulator will be installed in a new human research laboratory at the United States Naval Hospital.

The facility will be used to simulate deep sea conditions down to 2,250 feet. At 2,250 feet, the weight of the water is 1,000 pounds per square inch.

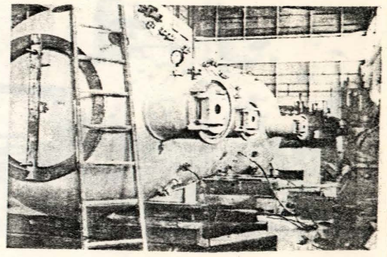

PHOTO #2 - Vessel being gas tested at 1,000 psi.

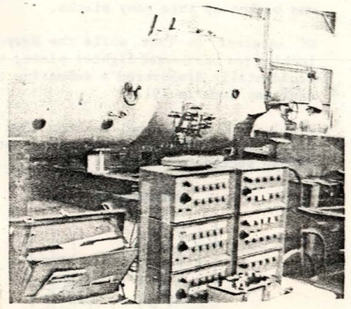

PHOTO #1 - Simulator being hydro and strain gage tested at 1,250 psi.

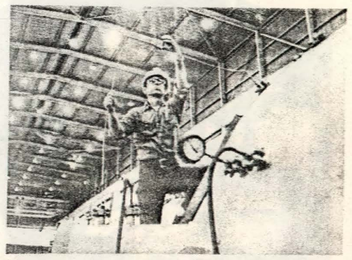

PHOTO #3 - Walt Christmas opening up a small valve to equalize the pressure in one of the (3) medical locks.

(Continued on page 4.)

(Continued from page 1.)

house and did a few chores in between. They sure did enjoy that! . . . Danny Fakus went to San Antonio and combined a vacation, honeymoon and visiting all into one. We hear they had a good time . . . Larry Megow was the guest speaker at the Annual Christmas Dinner-Dance, held by the International Maintenance Institute. Larry's presentation was on "The Murdock-Lockheed Lockseal for the Alaskan Pipeline . . . Leroy Faktor's stepson, Bob Aston, does in-service inspection of Nuclear Reactors. Leroy makes them and Bob inspects them. You can't beat that! . . . Everett Erwin has been off for several weeks and is recovering from surgery for a rattlesnake bite on his index finger. Everett was bitten on January 14th and we sure hope he'll be back soon . . . We hear that Art Davila, Department 3, got lost going home the other day. It seems he "forgot" he moved. Hmmmmmmm . . . Sandy Keys, Accounting, has put her 1966 Ford to rest and is now sporting a 1974 Cutlass Supreme . . .

Congratulations to Mike Rebstock, Ernst Heine and Velon Saint for a job well done. See the letter below which was received at Hahn & Clay . . .

BIG THREE INDUSTRIES, INC.

December 20, 1976

HAHN & CLAY
7196 Clinton Drive
Houston, Texas 77020

Attn: Mr. E. Hiney

Dear Mr. Hiney:

On behalf of Big Three Industries, Inc., I would like to take this opportunity to express our gratitude for your efforts in assisting us on Sunday, December 19th.

As we discussed yesterday, we needed machine re-work in the tripelier shaft and an oil slinger fixed, both on an emergency basis. Your provision of the machine, people to perform the required work for us enabled us to prevent a bad situation from occurring. Please extend our thanks to the people involved.

Again, thank you for the services provided when we so desperately were in need of them.

Best personal regards,

Bob Mackey
Buyer
Capital Goods & Contracts

. . . Tom Pool, Department 2, is home recuperating after suffering a heart attack January 6th. Tom will be off for some time but is doing fine. We all wish you well, Tom.

## BOWLING NEWS

Hahn & Clay Team #1, has settled into 4th place in the 28 team Esquire Bowling League as of January 19th. The competition has shown no mercy since Hahn & Clay held the #1 position for the first two weeks of December.

Recent highs for the team show Ron Megow with a 217 game and 585 series, Bill Merryman a 216 game and 573 series, and Gene Woodruff with a 501 series.

High game and series for Hahn & Clay #2 Team, bowling in the Gulfgate Commercial League, go to Charlie Driscoll with a 195 game and a 554 series. Congratulations, Charlie. Charlie's average is 147.

"It's amazing what we've been able to do with a little iron, steel, a few presses and 28 Million Dollars."

GUESS WHO?

Answer: William Victorian.



## JOB OF THE MONTH

by
Larry Megow

99700 is a deep ocean environmental simulator. It will be shipped by truck to Bethesda, Maryland, a small town on the edge of Washington, D.C.

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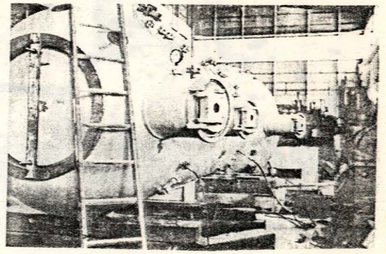

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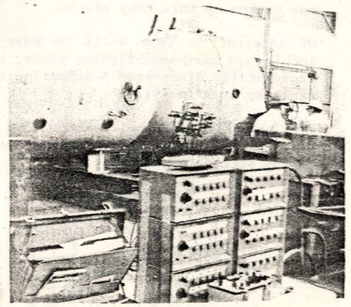

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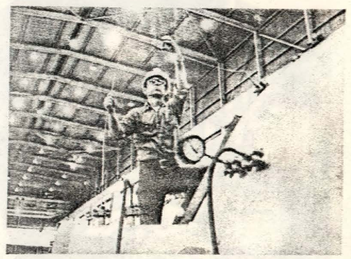


PHOTO #3 - Walt Christmas opening up a small valve to equalize the pressure in one of the (3) medical locks.

(Continued on page 4.)

# Deep Diving Research Lab Gets 'Wet Pots'

BETHESDA, MD.—Deep diving research in the Navy's new Environmental Health Effects Laboratory grew closer last month when the "wet pot" and chambers arrived for installation.

The new laboratory, part of the Navy Medical Center here, will not be ready for actual manned diving research for about 18 to 24 months.

First will come the installation, testing and certification of the equipment, which will allow the deepest "dry" dives anywhere in the United States—to depths of about 3,350 feet.

The $15 million laboratory, when completed, will have five chambers for human diving research and 21 animal chambers.

"It will have central laboratories for all departments doing hyperbaric research," Capt. James Vorosmarti Jr., MC, USN, deputy director of research institute, said. "All the chambers will be in one place."

Right now, Dr. Vorosmarti said, the hyperbaric equipment is scattered throughout several buildings, making it difficult to coordinate studies.

"A lot of our chambers are old and obsolete," he said.

The new, two-story laboratory (which lost some space in budget cuts) will allow higher-quality research, Dr. Vorosmarti said.

The bottom floor of the building is devoted to the hyperbaric equipment—one large room will house the animal chambers, a smaller one the manned ones. There will be a kitchen and a sleeping quarters for the crew that must stay near during a long "dry" dive.

Two of the five chambers for human research will be capable of the extremely high pressures—1,500 pounds per square inch—found at depths of about 3,350 feet, according to John Naquin, hyperbaric program manager.

The other two will go to 1,000 pounds per square inch, or about 2,250 feet.

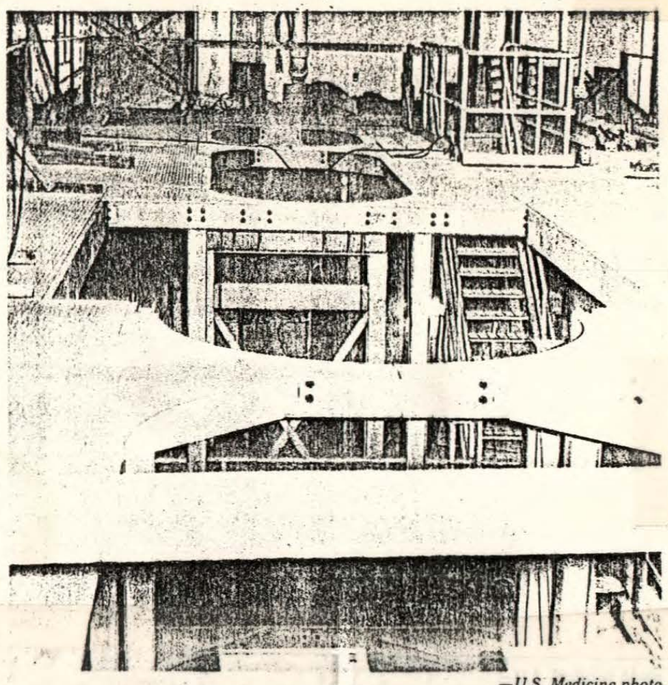
The difference between the two, Naquin said, is about three inches of steel—the deeper tanks being about five inches thick.

The top floor of the two-story building contains laboratory and office space. The labs already are being used for some types of research.

Once all contract work is completed next spring, Naquin said, the system will be used unmanned to make sure it meets specifications.

Then there will be a series of manned training and testing dives, again in part to certify equipment, lasting about nine months.

It will be about two years before actual research can begin, Naquin said.



—U.S. Medicine photo

Diving chambers will fit in these holes

No other diving laboratory in the United States is equipped to make dry dives to such depths, he said. However, Canada is building one in Toronto that will be able to go deeper.

Dr. Vorosmarti said the new laboratory will be used to begin or continue such inquiries as:

• Decompression theory and decompression sickness. There are no decompression schedules that cover all the different types of diving that must be done, he said.

The current tables are based on empirical data—they are not backed up by scientific evidence, though some of them work extremely well.

"But there is no basic theory or law behind them," he said. "We'd like to find one."

Dr. Vorosmarti said research also will be done to try to improve existing methods of treating decompression sickness.

• Thermal protection. "We know little about the limits of various types of diving," Dr. Vorosmarti said. "We need to measure thermal balance problems and find the information to design protective gear."

• Human performance. "We want to correlate performance problems with physiology in diving."

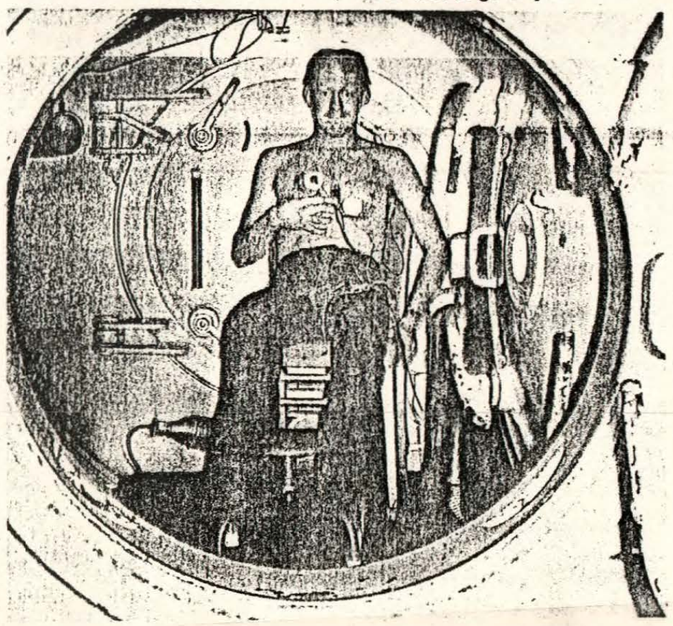
• High-pressure nervous syndrome. Both central and peripheral neurotransmitters seem to be affected by high pressures. There may be some way to obviate this problem.

• Oxygen toxicity. "We want to find out how to reduce it and see how to extend the limits of using oxygen under pressure," Dr. Vorosmarti said. Another study will examine the feasibility of using oxygen for decompression sickness.

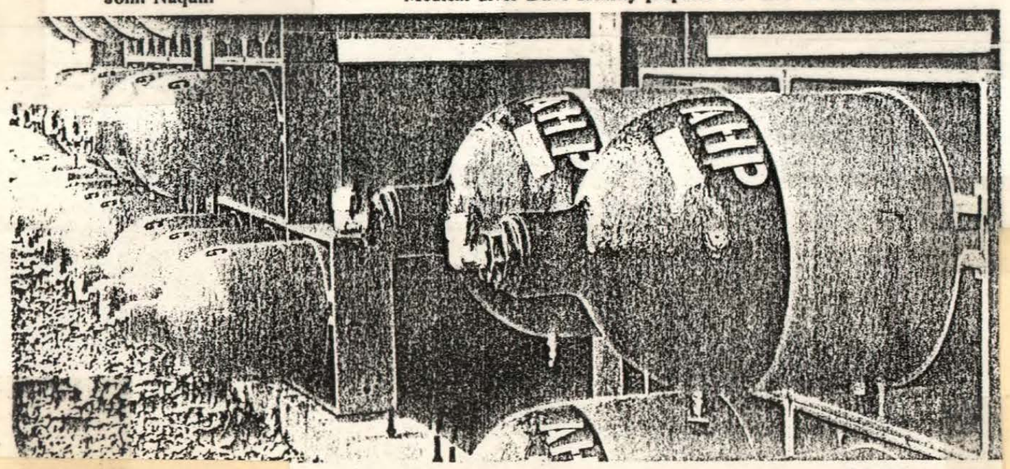
One project going on in the old facilities involves an attempt to correlate formation and quantity of inert gas bubbles in the blood with electrocardiograms.

Finding such a correlation, Dr. Vorosmarti said, might provide insight into the mechanisms and parameters of decompression sickness.

John Naquin



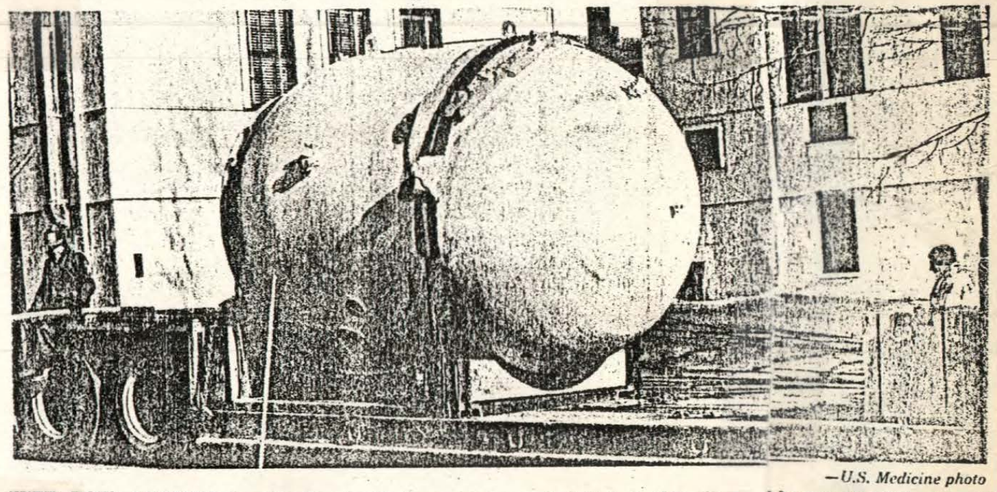
Medical diver Dave Hearny prepares for 'dive' in old chamber



Gas storage grid is just outside the laboratory

—U.S. Medicine photos

## Deep Diving Chambers Arrive



—U.S. Medicine photo

'WET POT' ARRIVES for the Navy's Environmental Health Effects Laboratory in Bethesda, Md. Once chambers are installed, the laboratory will be capable of the deepest 'dry' dives in the U.S.—down to 3,350 feet. Story, page 4.

# The HAHN & CLAY Anvil

Houston, Texas

THE ANVIL VOL. X. NO. MARCH 1, 1977


## JOB OF THE MONTH

by
Larry Megow

On January 22, 1977, most of you didn't pay much attention to two heat exchangers with a crooked snout on one end, as they slipped out of our plant.

Back in November, 1976, one of our good customers got hold of Ed Valicek and said, "Say Ed, we've got a couple of exchangers that are leaking. How fast can you re-tube them?"

Without too much investigation, Ed said, "We should be able to do it in 30 or 40 days"

But, then when Ed told Gene and Larry that what the shop had to do was machine out almost 300 tubes from each tubesheet, cut off one tubesheet, re-machine the cut end, automatic weld on a new tubesheet with almost 400° F preheat, re-assemble new tubes, roll one end and weld those 300 tubes on both ends, local stress relieve, U.T. inspect the circle and test both the tube and shell side, Larry and Gene said, "No way, looks like the best we can do is ship the first exchanger by March 22nd and if we're lucky, the second one can go by April 19, 1977.

Well, as I said in the beginning, both exchangers slipped out of our plant ahead of schedule on February 22, 1977.

Of course, we did work round-the-clock, but all the operations went like clockwork. U.T. inspection of the (2) circle seams showed no defects, the P.T. of the almost 1,200 tube welds revealed no defects and the hydrotests proved that the tube rolling, welding and machining was flawless.

There's no way we can show everybody who made this crash repair such a success.

(Continued on page 4.)

## Holidays for 1977

| | |
|---|---|
| NEW YEARS DAY | JANUARY 3, 1977 |
| GOOD FRIDAY | APRIL 8, 1977 |
| MEMORIAL DAY | MAY 30, 1977 |
| INDEPENDENCE DAY | JULY 4, 1977 |
| LABOR DAY | SEPTEMBER 5, 1977 |
| THANKSGIVING DAY | NOVEMBER 24, 1977 |
| CHRISTMAS DAY | DECEMBER 26, 1977 |

There is a floating holiday which may be used on Friday, November 25,1977,following Thanksgiving, however, there will be a later notice to verify this.

Kermit V. Lewis

Kermit V. Lewis

The HAHN & CLAY Anvil

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**(Continued on page 4.)**

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Kermit V. Lewis

Kermit V. Lewis

# CB Thief Nabbed

On Saturday, Dec. 18th, George Caldwell, Dept. 1, spotted two young boys in the parking lot. George summoned Shorty Jennings for help and then notified Ernst Heine to call the police.

George and Shorty then proceeded toward the parking lot when George spotted one boy on a bicycle with a CB under his arm. George jumped the fence and was able to grab the boy with an armlock. Heine reported that when he arrived at the driveway, George had boy, CB and bicycle.

The boy was turned over to Houston Police. Thanks go out to George for his role in capturing this CB thief.

"Glad you called, Mother. No, I'm not busy!"

And did you hear about the skeptical little girl who said: "if George Washington was such an honest man, why do they close all the banks on his birthday?"

# *Service Awards*

To acknowledge the years of effort and dedication given our company by its respected employees while performing their individual jobs, service emblems are awarded when an employee attains certain levels of consecutive years service to Hahn & Clay.

## SERVICE AWARDS

**5** Years - Sterling Silver Award

**10** Years - Solid Gold Award

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**20** Years - Second 5-point diamond added to gold award

**25** Years - Third 5-point diamond added to gold award

**30** Years - One 10-point diamond added to center of gold award, making a total of three 5-point diamonds and one 10-point diamond.

(Awards are available as tie tack, pin or necklace.)

**Calvin McDaniel (2-18-75), Turbine Shop, receives his five year award from Billie Sommer.**

# SPEED

by
Larry Megow

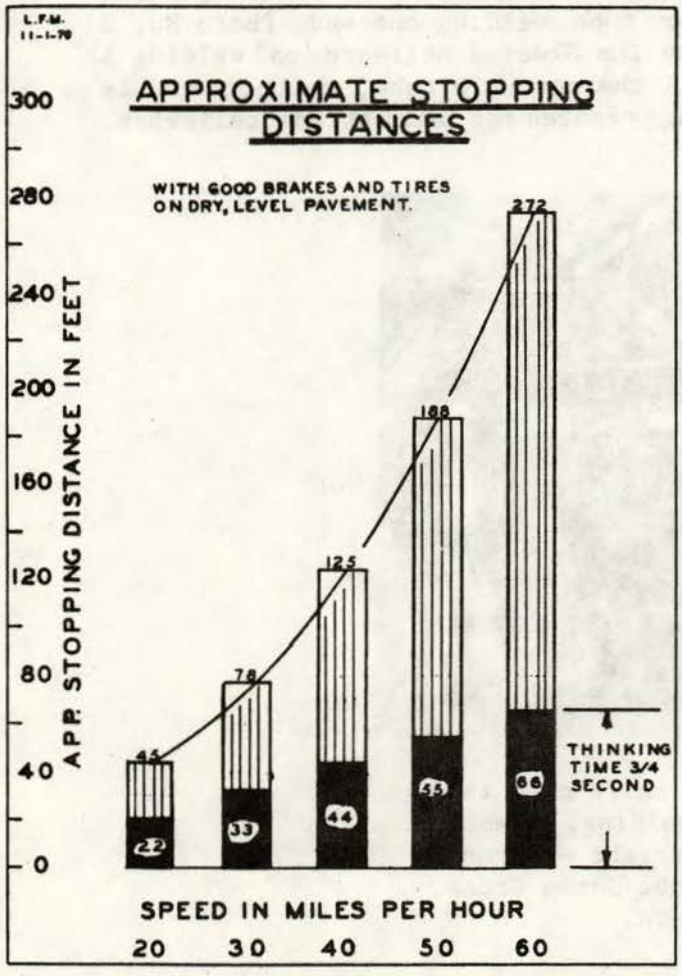
Do you realize that at 40 miles per hour your car travels almost 60 feet in one second? And, that at 55 miles per hour you roll 240' in just three (3) seconds?

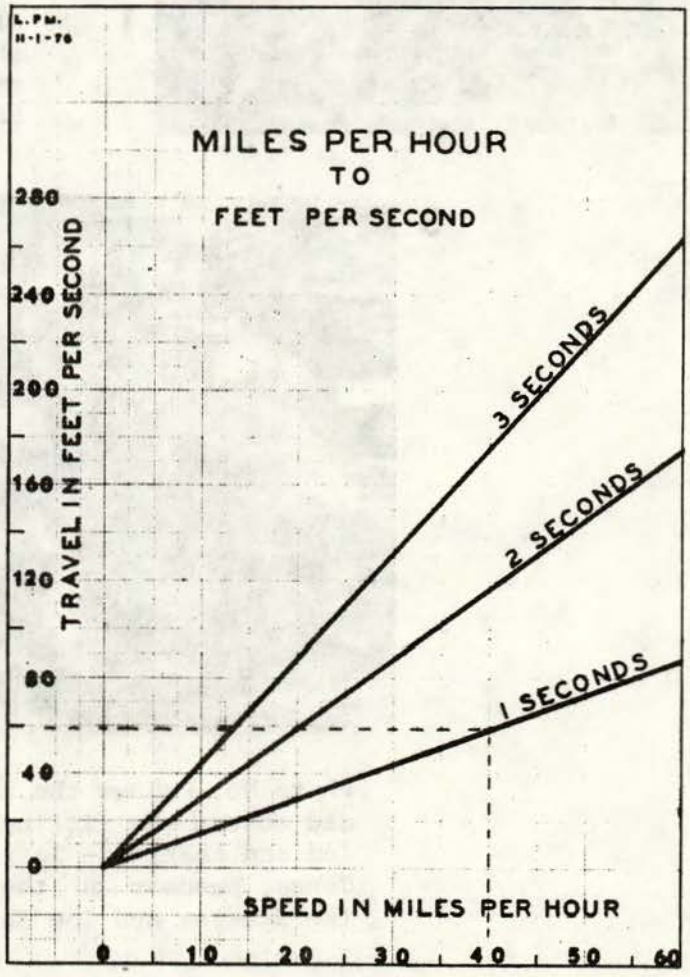
Even more important, do you know that at 40 miles per hour you cannot stop your car in much less than 125 feet --- even with good brakes and tires on a dry level pavement?

One more point. Driving at the 55 mile speed, your car will travel almost 60' in the 3/4's of a second while you are thinking about getting your foot on the brake.

The two graphs depict travel per second and stopping distances at any legal speeds.

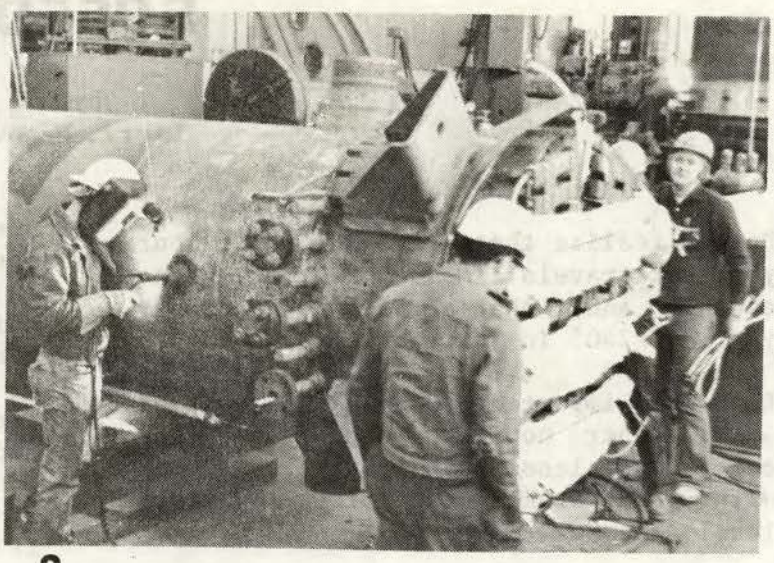
If you ever have to take another drivers test, you'll need this information.



(Continued from page 1.)

1



2

Photo No. 1 shows Earnest Jones cleaning after tube welding one end. Photo No. 2 shows Ike Skweres heli-arc seal welding a small thermocouple tube, while one end is being prepared for local stress relieving.

3

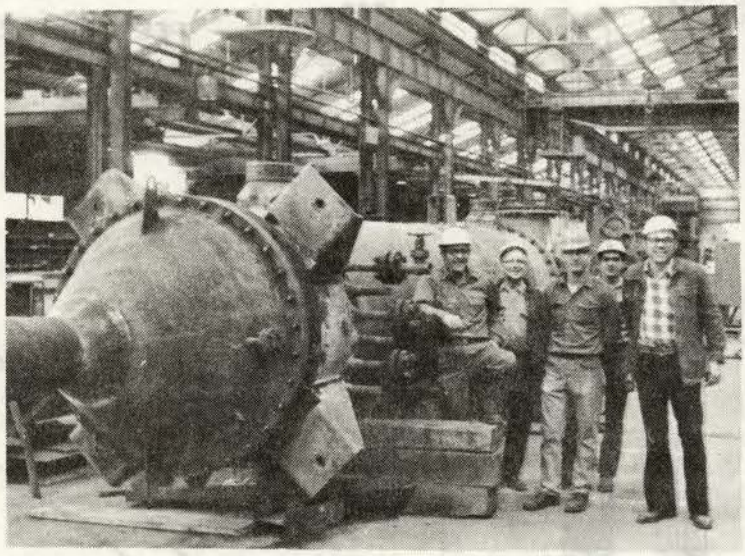
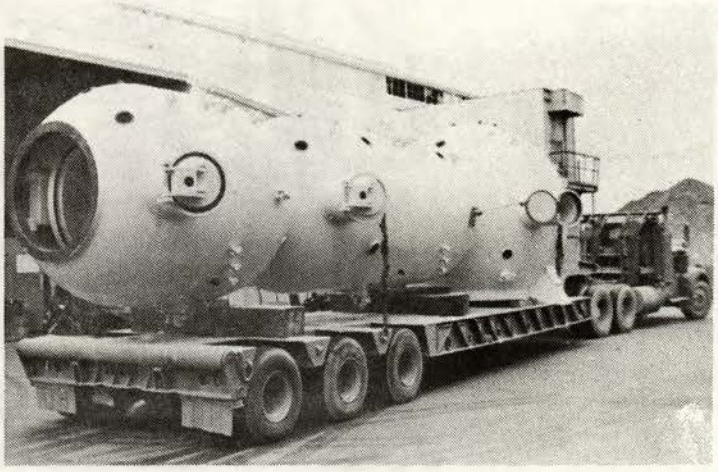


Photo No. 3 shows the day shift crew that did most of the fitting, welding, assembling and testing - left to right - Earnest Jones, Leadman on the job, James Cross, Ike Skweres and Joe Mattern.

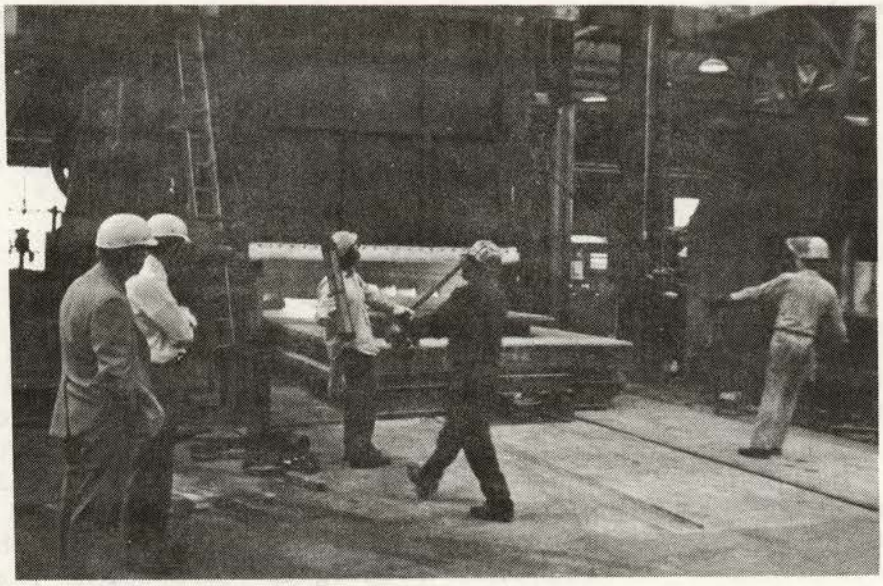
(Continued on page 10)

# HAHN & CLAY AT WORK

Ike Skweres heli-arc welding a small pipe in Job #19067.

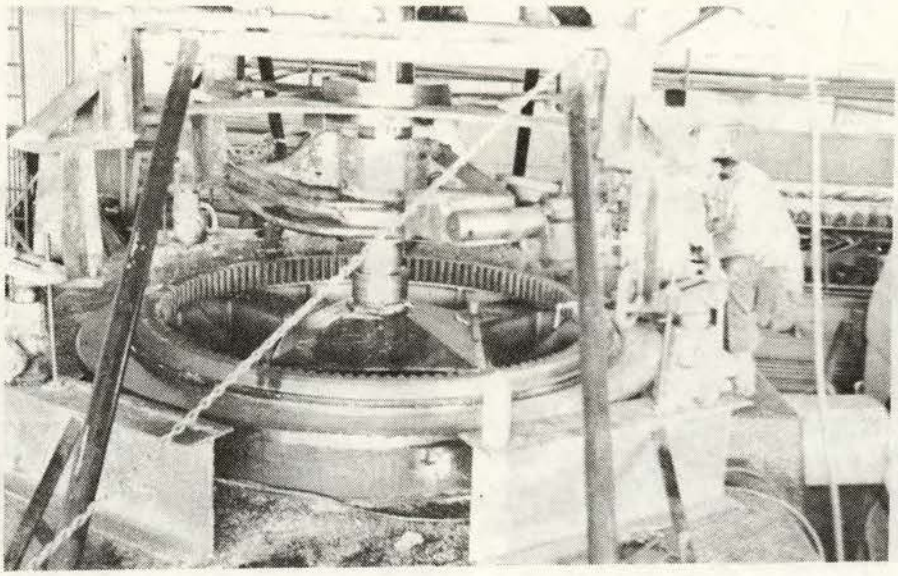


Deep Ocean Simulator, Job #99700, back from being painted a gleaming white.



Wally Urban, left, and Gene Woodruff look on as Roger Stevens, Jessie Manley and Floyd Kimich take the first heated plate out of the new 10' x 10' x 20' furnace. If you look real close you may see Johnnie Straka at the controls.

# FIELD MACHINING IN THE SHOP



Charlie Hall is at the controls of the portable flange facing machine. In this one set-up, the worn top surface of the 84" diameter by 8" wide table roller face and the 4" wide back "hook" face were turned up. The "table" was part of a 150 ton P&H motor crane. Milton Keefer and John Allington set-up for this complex machining operation. Ralph Spicer helped with the machining.

## BOWLING NEWS

Hahn & Clay Team #1 has run into some bad luck the last four weeks. While the scores have been relatively good, the opposition has been that "little bit better" and made winning very difficult. The results show 6 wins and 10 losses, dropping the team to 9th place in the 28 team league.

Charlie Driscoll, substituting recently for Bill Merryman, bowled the highest game of his career when he socred a big 215 game. He was bowling with a 149 average that night. Other noteworthy scores show Bill with games of 218 and 204 and series of 590, 512 and 508; Ron Megow a 201 game and series of 550 and 540; George Perez had series of 536, 508 and 507; Gene Woodruff a 538 series and Robert Kieschnick a 509 series.

Hahn & Clay Team #2, bowling in the Gulfgate Commercial League, also has some scores to report. Earl Franklin, Department 1, got the high game for the team with a 217 game and Charlie Driscoll bowled his first "500" series with games of 168-178-199 = 545.

Congratulations to both of you.

# LIFE LINES

by
Barbara Roth
and
Billie Sommer

Jose Vitela has taken two weeks vacation recovering from recent nose surgery . . . Clarence Buck returned to work February 23 after being off for several weeks fighting a battle with penumonia . . . Ron Megow, who has a 179 average in bowling, seemed to have trouble finding the pins recently. Ron says he hadn't had a drink all evening but his score of 118 for one of his games would lead one to think otherwise . . . "Little Rob" took a week of his vacation in order to participate in one of the trail rides for the rodeo . . . Frank and Margaret Spencer recently celebrated their 12th Wedding Anniversary . . . Juan Saucedo and Alvin Morgart each took a week of vacation last month and got some repair work on their cars taken care of . . . Roy Turner, Machine Shop, took some time off recently and went to North Carolina to visit his son who had surgery. Roy is back now and we hope all went well . . . Joe Doherty has been out ill for the past month and is now recuperating from pneumonia. Joe hopes to be back to work by the middle of March. We all hope he is feeling better . . . Ed Valicek, Sales, is seen below with a grey fox he killed on a hunt this past season. Ed is planning to mount his prize.

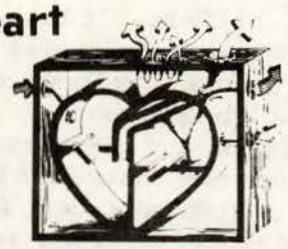
. . Billy Kelley is hobbling around after a recent accident when he broke his big toe. Billy hasn't let it slow him down too much and only missed a few days of work . . . Tony Cardenas took a week of his vacation last month . . . Congratulations to James and Barbara Green who recently celebrated their 21st Wedding Anniversary . . . Richard Lewis, Fabricating, spent a week of his vacation in our sister state, Louisiana . . . Charles Reinhart is home recovering from an accident that resulted in the loss of two of his toes. We all wish Charles well and hope he will be feeling better soon . . . Mary Brashier, receptionist, was caught in this photo having the "time" of her life recently at a costume party.

Virgil Watson and Jim Hamilton from the Turbine Shop each took a week of vacation last month . . . Belated Happy Birthday wishes to Verlon Powdrill who recently celebrated his 54th birthday . . . Virgil Strong, Maintenance Department, is peddling a new Datsun Pick-up truck . . . Hibbard Cox, Quality Assurance Department, took a week of his vacation in February . . . Bill Tengler had surgery on his ear February 14th. Bill is home now and seems to be recovering very well. Hopefully, Bill will be back with us soon . . . Congratulations are certainly in order for Sadie Renfro, Leonard's wife. Sadie bowled her first 600 series recently. Her scores were 226, 221 and 181 . . . Lorenzo Garcia, Fabricating, was hospitalized recently for injuries he

(Continued on page 8.)

## Take it to Heart

**More than half of all heart attack victims die outside the hospital, most within two hours of initial symptoms. If you experience these warning signs of heart attack or stroke, seek emergency assistance at once. When it is not available, get to a hospital emergency room any way you can and as fast as you can.**



### The Warning Signs of Heart Attack

- Prolonged, oppressive pain or unusual discomfort in center of chest, behind the breastbone.
- Pain may radiate to shoulder, arm, neck or jaw.
- Sweating may accompany pain or discomfort.
- Nausea, vomiting and shortness of breath may also occur.
- Symptoms may subside and then return.

### The Warning Signs of Stroke

- Sudden, temporary weakness or numbness of face, arm or leg.
- Temporary loss of speech, or trouble in speaking or understanding speech.
- Temporary dimness or loss of vision, particularly in one eye.
- An episode of double vision.
- Unexplained dizziness or unsteadiness.
- Change in personality, mental ability, or the pattern of headaches.

## *Half the Battle?*

**A pastor delivered a beautiful sermon describing the plight of the poor and how it was the charitable duty of the rich to share their wealth with the poor.**

**After the service, a friend asked how it went. "Well, it was partly successful," said the minister. "I convinced the poor."**

**—THE ZELIENOPLE (PA.) BUTLER COUNTY NEWS-RECORD**

(Continued from page 7.)

suffered as a wittness to a robbery in a U-Tote-M. Lorenzo was beaten and robbed, himself, and then his car was stolen. We understand he is doing fine and only expects to be off for one week . . . George Caldwell took two weeks of his vacation in order to stay home due to back problems,

## GUESS WHO?

Can you guess who the individuals are in this picture? In not, turn the page upside down for the answer.

---

Both individuals are Ed Valicek in this trick photograph. It was taken about 1944 while Ed was serving in the United States Air Force.

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## LUNCH BREAK

William Trapp, Glen Bartee and Billy Kelley taking a noon lunch break.

# Energy from Texas Coal

by

Larry Megow

Ya'll have heard about the energy shortage and that until we can build more nuclear power plants, coal will be used as a power source.

Texas already has several lignite coal power plants, including Alcoa's big installation at Rockdale and one at Fairfield.

Brown and Root has recently completed another power plant near Mount Pleasant on Highway 67, about 120 miles East of Dallas.

The new plant, Monticello Steam Electric Station, has two 575 megawatt generators whose output will be shared by Dallas Power & Light Company, Texas Electric Service Company and Texas Power & Light Company.

The amount of dirt moved and the coal dug at Monticello is staggering.

Over the 30 to 35 year Monticello plant life, 14,000 acres will be stripped and mined. The land will be recalimed to its original topography.

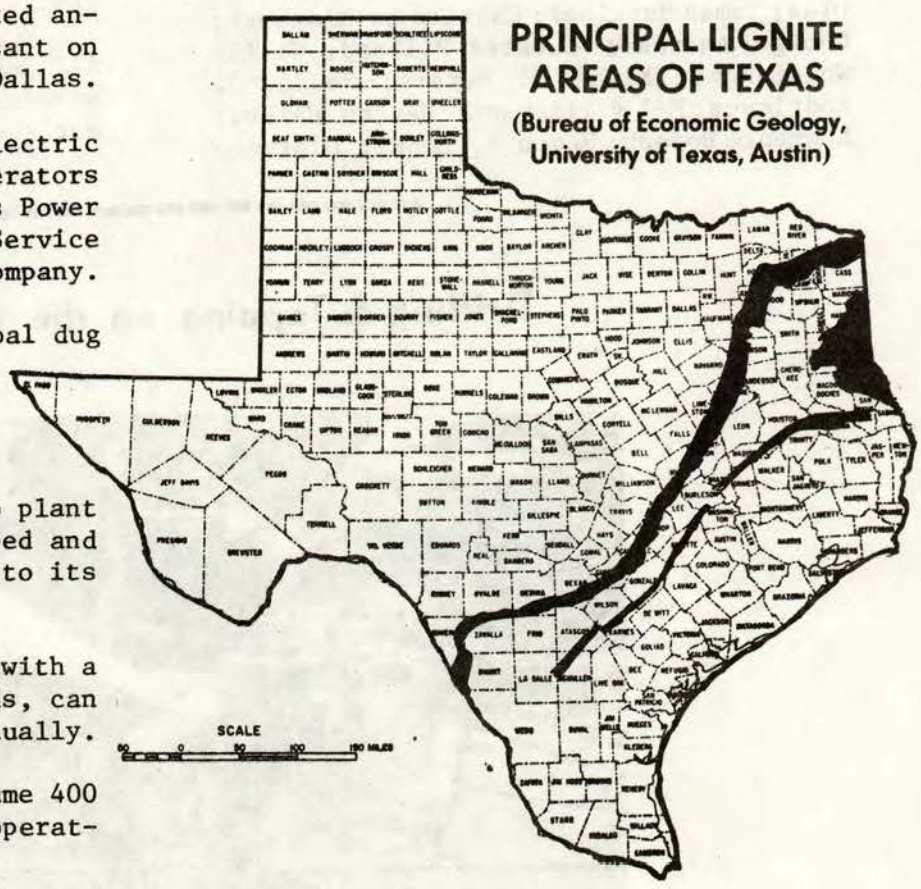
Two (2) 2,900 ton draglines, each with a bucket capacity of 70 cubic yards, can handle 24 million cubic yards annually.

The two 575 megawatt boilers consume 400 tons of lignite coal per hour when operating at full capacity.

Each boiler produces over 4 million pounds of steam per hour for delivery to the turbines.

The lignite, stripped in big chunks, is first crushed to 6" size. It is then reduced down to around 1/2" diameter and eventually ground to a fine powder before it is forced, by a pneumatic fueling system into the boilers.

Lignite coal can be found in Texas in a 10 to 30 mile wide strip, all the way from Eagle Pass up to Texarkana; a 3 to 5 mile strip from Cotulla to St. Augustine and large deposits in Harrison, Rusk, Magnolia and Shelby Counties in East Texas.



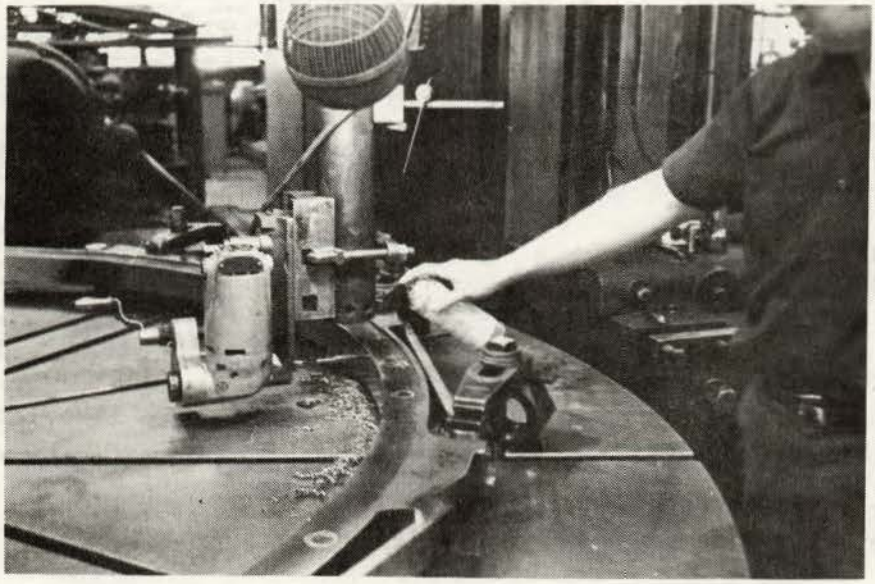

If we continue to strip mine lignite at the present rate of around 60 million tons annually, it is estimated that we will not run out of Texas coal for almost 100 years.

(Continued from page 4.)

But, in addition . . .
Willie Gummelt; James Quinton, Ike Gurka; George Perez; Gerald Watson; Leon Spear; Ike Skweres; Danny Fajkus; Charles Hall; Chris Marshall; Harold Myers; James Cross; Elton Matthews; Virgil Watson; William Grisham; Alvin Morgart; Earnest Jones; Leonard Renfro; Calvin McDaniel; William Smith; John E. Robinson; Weldon Ballew; Genaro Isaac; Charles Zeigler; Garland Woodard; Sidney Parr; Oswald James; Ernst Heine; James Washington; Jimmy Abraham; Douglas Sutter; Dallas Craddock; Arthur Diaz; Tomas Martinez; Charles L. Rinehart; George Andrade; Chester Pillard; Willie Whisenhunt; Klaus H. Peters; Julian J. Rodriquez; Mel Williamson; Warren Walker; Lawrence Hodson; Ramon E. Lopez; Clarence Robinson; Dennis Rushing; Cleodis Green; Herman Miles; Burt Kilner; Everett Erwin; Earl L. Williams; Mike Bush; Steve Golden; Herman Manning; Jairo Gomez; Owen Beeler; Richard Creasman; John D. Moreno; Clarence Lewis; Michael Ward; Joe Almendarez; Jose Perez; Juan Montemayor; Alex Martinez; Leroy Kurtz; Joseph Mattern; Marshall Brantley; Gene Ebelt; Verlon Powdrill; Reubin Simmons; Mike Rebstock; Kenneth L. Jones; Henry Kominczak; Roy Turner; Michael Parsons; Claven Franklin; Hibbard Cox.

All helped complete this job ahead of schedule and to more than meet the customer's quality requirements.

## Drilling & Tapping on the 10' Mill



Who says we can't drill and tap on the 10' mill? No one, because Pete Commiato and Jack Downey did drill holes inside a ring on Job No. 19612.

# The HAHN & CLAY Anvil

Houston, Texas

THE ANVIL VOL. X. NO. MARCH 1, 1977


## JOB OF THE MONTH

by
Larry Megow

On January 22, 1977, most of you didn't pay much attention to two heat exchangers with a crooked snout on one end, as they slipped out of our plant.

Back in November, 1976, one of our good customers got hold of Ed Valicek and said, "Say Ed, we've got a couple of exchangers that are leaking. How fast can you re-tube them?"

Without too much investigation, Ed said, "We should be able to do it in 30 or 40 days"

But, then when Ed told Gene and Larry that what the shop had to do was machine out almost 300 tubes from each tubesheet, cut off one tubesheet, re-machine the cut end, automatic weld on a new tubesheet with almost 400° F preheat, re-assemble new tubes, roll one end and weld those 300 tubes on both ends, local stress relieve, U.T. inspect the circle and test both the tube and shell side, Larry and Gene said, "No way, looks like the best we can do is ship the first exchanger by March 22nd and if we're lucky, the second one can go by April 19, 1977.

Well, as I said in the beginning, both exchangers slipped out of our plant ahead of schedule on February 22, 1977.

Of course, we did work round-the-clock, but all the operations went like clockwork. U.T. inspection of the (2) circle seams showed no defects, the P.T. of the almost 1,200 tube welds revealed no defects and the hydrotests proved that the tube rolling, welding and machining was flawless.

There's no way we can show everybody who made this crash repair such a success.

(Continued on page 4.)

## Holidays for 1977

| | |
|---|---|
| NEW YEARS DAY | JANUARY 3, 1977 |
| GOOD FRIDAY | APRIL 8, 1977 |
| MEMORIAL DAY | MAY 30, 1977 |
| INDEPENDENCE DAY | JULY 4, 1977 |
| LABOR DAY | SEPTEMBER 5, 1977 |
| THANKSGIVING DAY | NOVEMBER 24, 1977 |
| CHRISTMAS DAY | DECEMBER 26, 1977 |

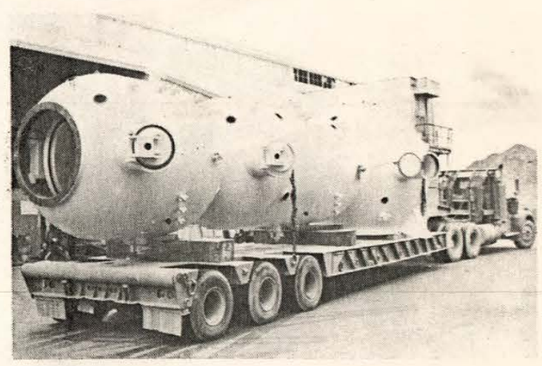
There is a floating holiday which may be used on Friday, November 25,1977,following Thanksgiving, however, there will be a later notice to verify this.

Kermit V. Lewis

Kermit V. Lewis

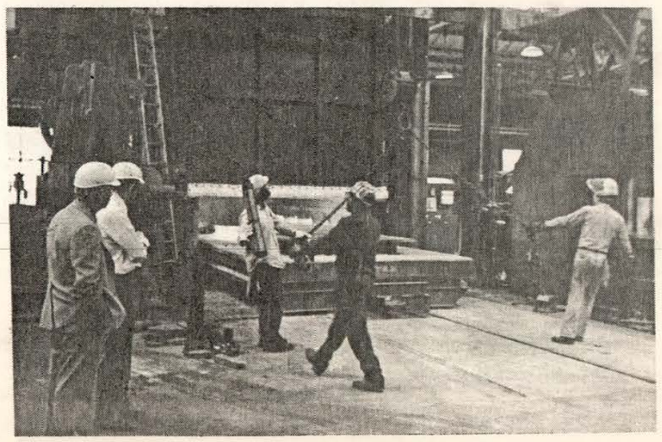


## HAHN & CLAY AT WORK

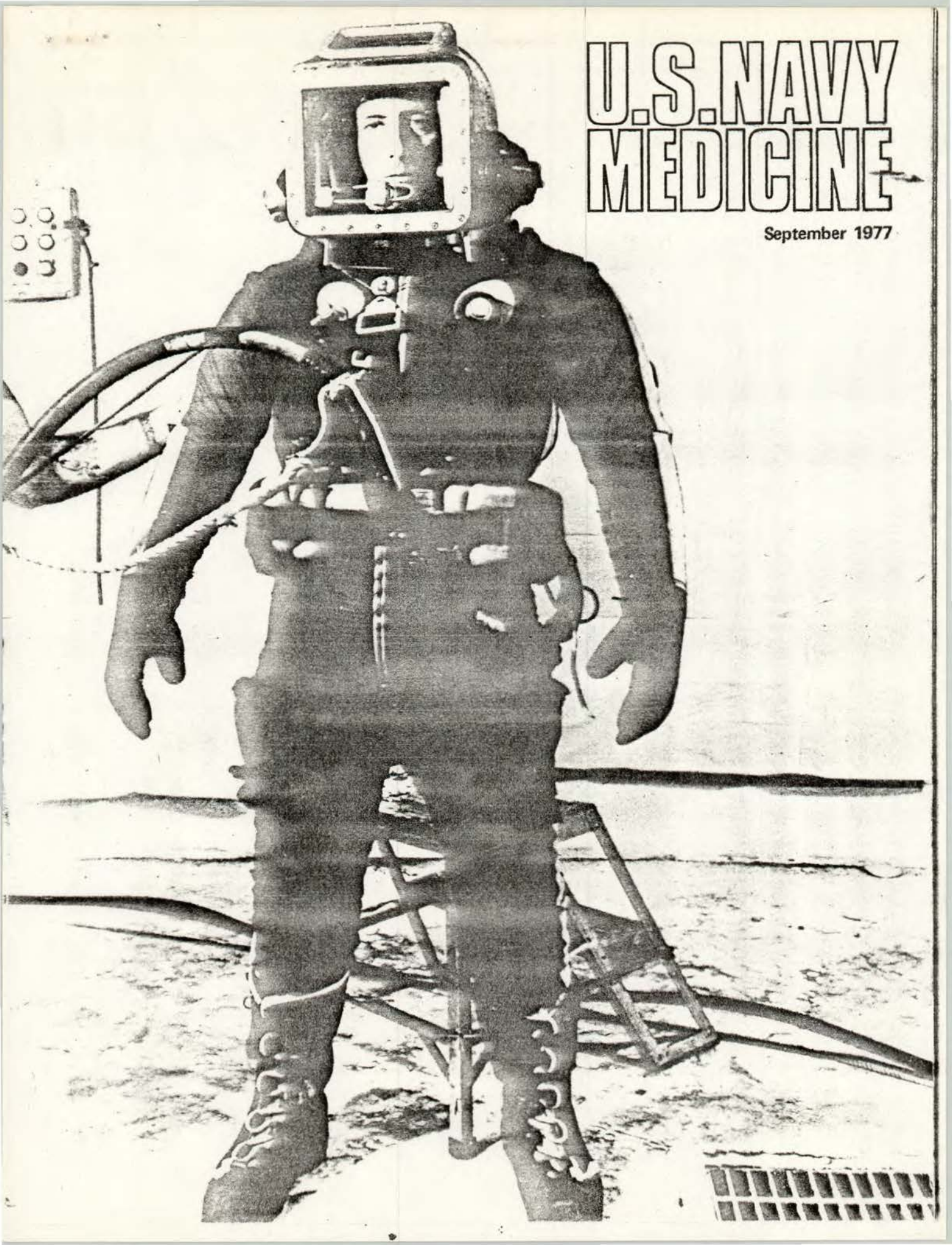


Deep Ocean Simulator, Job #99700, back from being painted a gleaming white.

ke Skweres heli-arc welding a small ipe in Job #19067.



Wally Urban, left, and Gene Woodruff look on as Roger Stevens, Jessie Manley and Floyd Kimich take the first heated plate out of the new 10' x 10' x 20' furnace. If you look real close you may see Johnnie Straka at the controls.



# U.S. NAVY MEDICINE

September 1977

# Navy Diving Biomedical Research and Development: The NMRI Program

Mary M. Matzen

The Naval Medical Research Institute (NMRI) in Bethesda, Md.—a multidisciplinary research facility sponsored by the Naval Medical Research and Development Command—is the Navy's lead laboratory for diving biomedical research and development.

Investigation into the biomedical problems of fleet divers has been under way at NMRI since 1942. Today, research efforts range from finding timely solutions to diving medical and operational problems encountered within the current 1,000-foot diving capability, to developing methods for effective diving to 2,500 feet by 1985.

NMRI diving researchers will soon have a greatly expanded research capability: a new hyperbaric research facility, which will house a wet pot capable of simulating depths to 3,300 feet of seawater (fsw) and will include living quarters and support for divers under pressure. With this capability, NMRI can conduct advanced human hyperbaric research in its own laboratory.

For animal studies, the new complex will provide 21 smaller chambers capable of simulating 3,300 fsw. A mobile service chamber will permit test animals to be held under pressure while their chambers are cleaned; such an arrangement will enable researchers to carry out long-term studies under pressure.

Animals are used initially to test techniques developed for eventual human experimentation—drug interactions, for example.* Animals are also used in experiments where use of human subjects is not feasible: for example, deep electrodes are implanted in animals to establish the relationship between brain activity and hydrostatic pressure.

Investigators also test new concepts on animal models and only after thorough testing will move on to human experimentation, with volunteer Navy divers serving as subjects. One example: an animal experiment involving the estimation of time has contributed to the understanding of how human divers adapt to repeated hyperbaric exposures. Time estimation in animals is a sensitive response to experimental manipulations. It is also a precise technique for measuring human performance. In an adaptation study by Thomas and associates (*1*), rats were trained by operant techniques to press a lever at regular time periods. Stable performance baselines were established for each animal. The training was done at "surface" pressure (1 atmosphere).

The rats were initially exposed to hyperbaric pressure in a simulated pressure-chamber dive to 200 fsw while they were breathing compressed air. This initial exposure to pressure disrupted and modified the established performance baseline by substantially increasing responses. Further experimentation showed that when intervals of time were allowed to elapse between subsequent dives, the timing precision of the rats at 200 fsw was not disrupted; the rate of response returned to surface baseline values.

When Navy divers were asked to punch buttons under the same environmental conditions, the results were similar.

## COPING WITH PRESSURE

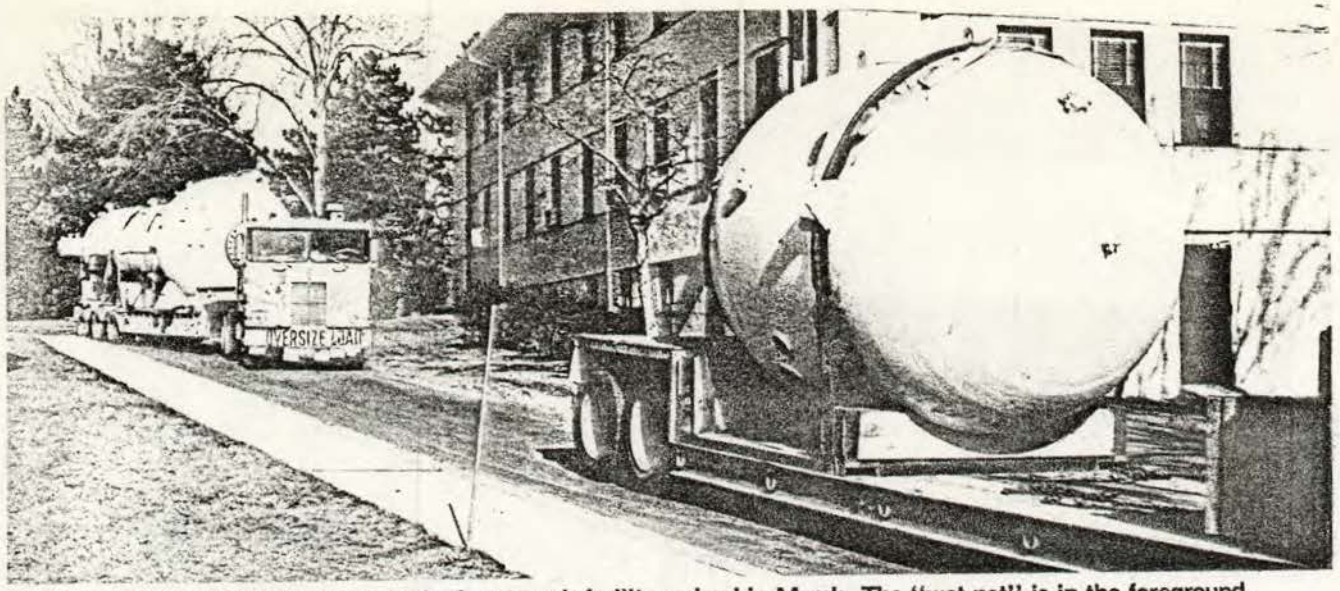
Many of the diver's physiological problems stem from the effects of pressure on his body. This pressure is made up of two forces: the weight of the water over the diver, and the weight of the atmosphere over the water. With each 2-foot increase in depth of seawater, pressure increases by almost one pound per square inch (psi). Each 33 feet of descent in seawater increases the pressure by an additional atmosphere (14.7 psi). The effects of pressure can be grouped into two categories: direct or mechanical effects, such as the compression of body air spaces during descent; and indirect effects, which result from changes in the partial pressures of gases in the breathing medium (*2*).

The breathing medium means life to the diver, but it is also the source of many of his physiological problems because, under hyperbaric pressure, the diver's body interacts with the breathing gases. The breathing equipment itself, which delivers and regulates the gases, can also cause or extend many of the diver's problems.

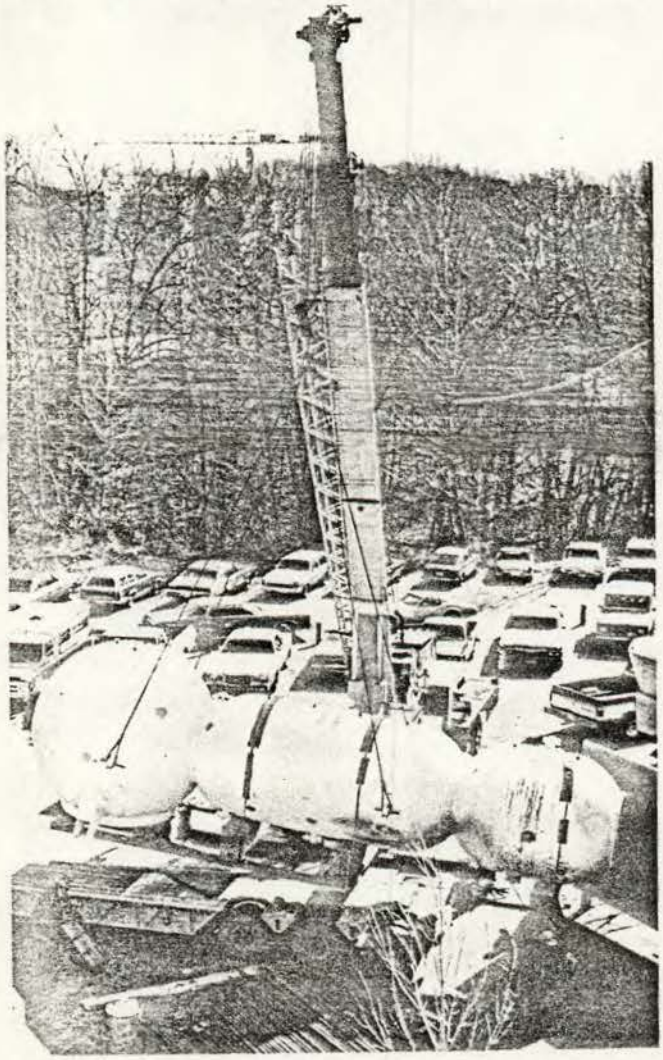
Because of its ready availability and low cost, compressed air is the breathing mixture most commonly used for dives as deep as 150 fsw. Mixed gases are used

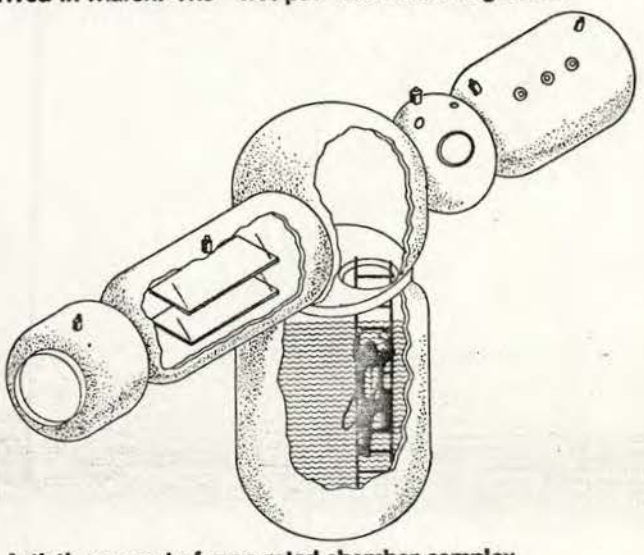
From the Behavioral Sciences Department, Naval Medical Research Institute, National Naval Medical Center, Bethesda, Md. 20014.

*Animal experiments are conducted in accordance with the principles set forth in the "Guide for the Care and Use of Laboratory Animals," Institute of Laboratory Animal Resources, National Research Council, Department of Health, Education and Welfare, Publication No. (NIH) 74-23.

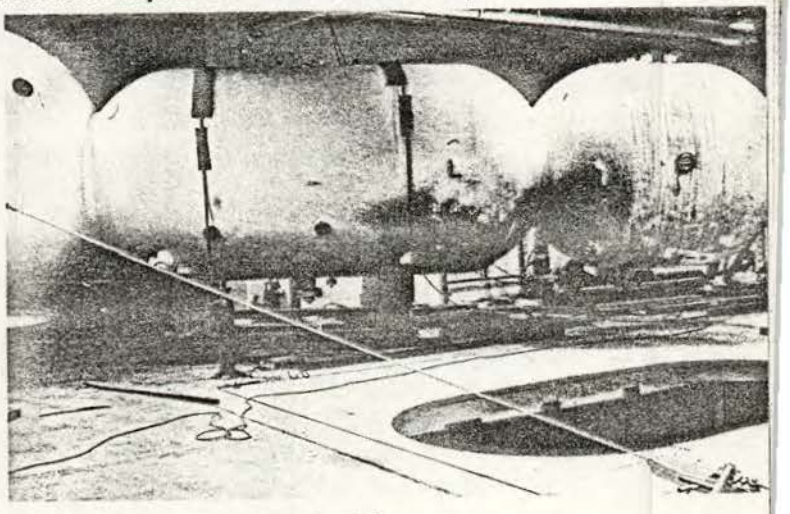


The first section of NMRI's new hyperbaric research facility arrived in March. The "wet pot" is in the foreground.

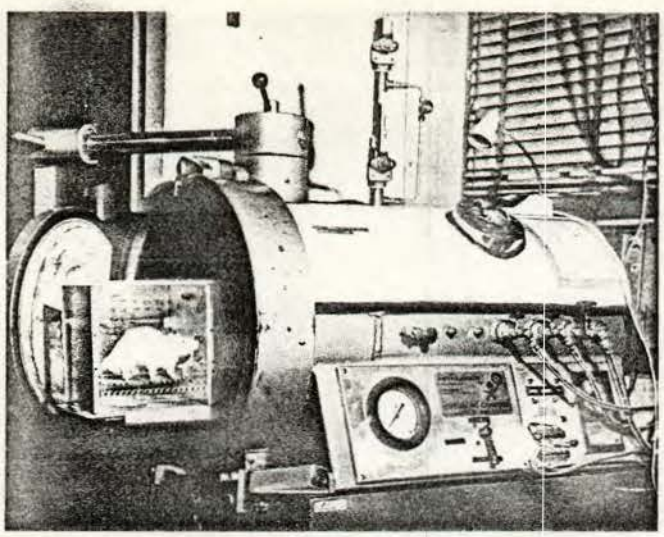




Artist's concept of man-rated chamber complex



(Above) Dry chamber is unloaded and (right) installed in NMRI lab. Second section arrived in July.



**Hyperberic chambers used for test animals**

when the diver descends deeper and stays longer. Although all breathing mixtures must supply a limited amount of life-supporting oxygen, toxicity occurs when the diver breathes excessive amounts of oxygen under pressure. Nitrogen or helium are routinely used as diluents for oxygen, depending upon the depth and duration of the dive. But these inert gases have their own unique disadvantages. For example, nitrogen causes narcosis and increased breathing resistance, and requires the diver to undergo longer periods of decompression. Helium causes rapid loss of body heat, "Donald Duck" speech, and altered excitability of the nervous system.

Basic to solving these problems is the need to define inert gas transport and elimination in the body. Inert gases used as diluents for oxygen are taken up by body tissues under pressure, in a process called "saturation." As the pressure is reduced, the gases must be returned from these tissues—that is, the tissues are desaturated—but in a form that does not inflict acute or chronic injury. To avoid such injury, safe decompression schedules are vital. But such decompression schedules must be based on a quantitative understanding of inert gas transport in the human body; this understanding does not yet exist.

Decompression is defined as a release of pressure, and decompression sickness as the "overt illness which follows a reduction of environmental pressure, sufficient to cause the formation of bubbles from the gases which are dissolved in the tissues" (*3*). The importance of carefully controlled pressure reduction has long been established, but little is known about its effect on bubble formation in living tissue.

The symptoms of decompression sickness are the result of bubbles forming in the vascular system or tissues. These symptoms can be as innocuous as temporary skin rash or mild discomfort in the joints and muscles, but may also include paralysis, numbness, hearing loss, vertigo, unconsciousness, and death (*2,4*). Decompression sickness is treated by recompressing a diver to a pressure sufficient to allow the bubbles to dissolve. When the symptoms have cleared, decompression schedules may be used to decompress the diver to surface pressure.

New modes of therapy for decompression sickness are needed, as well as optimal decompression tables for manned saturation and subsaturation dives. NMRI researchers, focusing on the pathophysiology of decompression sickness (*5*), are attempting to:

- define the mechanisms by which central nervous system and joint dysfunction occur in decompression sickness.
- establish the impact on cardiopulmonary function of the bubbles formed during the decompression process.
- elucidate the interaction of these bubbles with the microcirculation (*6,7*).

The results of this work can be applied to the clinical problems of cerebral air embolism, spinal cord trauma, and stroke. An ultimate goal is to develop objective criteria for diagnosing and predicting decompression sickness, as well as methods for assessing the adequacy of decompression and for detecting tissue damage.

## TOXIC EFFECTS OF OXYGEN

To increase diver safety and effectiveness, researchers at NMRI are also striving to understand the basic mechanisms that cause inert gas narcosis. Through animal studies, they are attempting to determine the site of action of narcotic gases and to understand the alterations in membranes that narcotic substances may induce. The interaction of inert gas narcosis and environmental factors such as cold, high concentrations of inspired carbon dioxide, compression rates, and the like must be assessed as they relate to altered cognitive and neuromuscular performance of underwater tasks.

The toxic effects of oxygen are related to the oxygen partial pressure in the breathing medium. Yet elevated partial pressures of oxygen are widely used to speed up decompression and to treat decompression sickness, air embolism, and other clinical problems such as gangrene and carbon monoxide poisoning. Determining the limits of safe oxygen partial pressures to which divers can be exposed is further complicated by the variation in oxygen tolerance among individuals and in one individual from day to day. Individual tolerances also vary between work and rest exposures and wet and dry environments. These considerations affect all phases of diving as well as the design of diving equipment.

The syndrome of oxygen toxicity is being studied at NMRI in intact animals. Researchers are also assessing in organ systems of animals the cellular and biochemical changes that precede and accompany the body function alterations seen in oxygen toxicity. The search is

for a way to modify an organism's susceptibility to oxygen toxicity.

The nature of the underwater environment itself is a continuing hazard to the respiratory and circulatory systems. NMRI investigators are trying to determine the "normal" respiratory state for divers, and to establish safe tolerance limits for carbon dioxide retention. Studies are also under way to evaluate the effects of immersion, pressure breathing, external impedance to breathing, and gas density as they relate to the mechanical work of breathing, the energy cost of breathing, and the efficiency of the respiratory muscle. The amount of ventilatory loading a diver can tolerate and the high-pressure nervous syndrome may constitute limits (as yet undefined) to man doing useful work under water. Information from the NMRI studies can also be applied to clinical problems of respiration, such as emphysema and chronic lung disease.

A diver's cardiovascular function is affected by hydrostatic pressure, the nature of the inert gas in the environment, and the high partial pressure of oxygen. The ultimate goal for this work at NMRI is to determine the depth limit at which the circulatory system will function properly. Initially, animal studies will assess the effects of increased pressure and various gas mixtures on the physiological components of the circulatory system at graded hyperbaric pressures. Studies using human volunteers will assess cardiovascular function as it relates to submaximal work in mixed-gas environments at low and high pressures, in wet and dry environments, during long-term exposures, and during compression and decompression.

Cold is particularly penetrating in the diving environment: underwater work in 25° C water produces thermal stress in less than an hour. NMRI scientists are now examining cardiovascular, pulmonary, and endocrine response to thermal stress in the immersed diver at shallow depths (*8*) by monitoring cardiac and respiratory rates, pulmonary ventilation, oxygen and carbon dioxide production, and core temperature. Blood and urine samples are obtained from each diver before, during, and after exposure, so researchers may analyze stress hormones and other biological variables.

Related work focuses on devising methods to precisely quantify, by heat-flux sensors and thermistors, the respiratory and skin heat loss of divers. The goal is twofold: first, to devise equations that predict heat loss and body temperature for any combination of ambient pressure and temperature; second, to define the tolerable range of deviation from normal skin-body temperatures under hyperbaric conditions. The relationship between body heat loss, temperature, and performance will be investigated and defined. The various levels of body heat loss will be correlated to changes in performance on underwater tasks requiring manual dexterity, a sense of touch, strength, and cognitive function—tasks such as would be encountered in underwater rescue or underwater construction and maintenance, for example. This information could lead to the design of equipment to ensure that divers maintain the body heat they need for top performance; it will also provide guidelines for diver rescue and for coping with the heat loss a diver experiences when his equipment fails. The possible relationship between thermal balance and decompression sickness will also be investigated.

**Work sled ergometer measures diver's performance**

## ASSESSING UNDERWATER PERFORMANCE

The study of underwater performance and performance physiology is crucial to the Navy's diving operational goals. The ultimate performance goal is to enable Navy divers to carry out their missions with little or no performance degradation as a result of the environment, diving techniques, or equipment. To attain this goal, diving officers must be able to predict and assess diver performance. At present, there is no body of information that clearly defines the safe working limits of the diver relative to his task, equipment, physical endurance, and physiological weakening.

In general, the factors that contribute to diving performance limitations fall into three categories: sensory limitations, cognitive limitations, and motor performance limitations. A diver's visual field and depth perception are severely limited under water; his judging, estimating, and discriminatory abilities may be affected by the dive conditions, and his motor performance is degraded by cold, neutral buoyancy, and the limited visibility.

A particular motor degradation, the "high-pressure nervous syndrome," occurs at depths of about 1,000 fsw and beyond. This syndrome is believed to result from a disturbance of central nervous system function. Its symptoms appear as electroencephalographic irregularities, tremor, loss of vigilance, altered posture and

balance, fatigue, and microsleep. Researchers at NMRI are investigating the effects of temperature and rate of compression on the high-pressure nervous syndrome to determine whether a diver can adapt to this condition, and if so, to what degree. The use of additive gases, such as higher percentages of nitrogen, are being investigated as a way of reducing these symptoms. Also, the basic mechanisms of the high-pressure nervous syndrome are being studied to obtain further information about the onset, nature, and treatment of this condition.

There is yet another factor in performance degradation under hyperbaric conditions: the effect of pharmacological agents and compounds. Because of accidents, decompression sickness, minor illnesses, pain or discomfort, divers are often taking some medication. Yet drugs that are considered safe and effective at surface pressure may have an altered effect on biological systems in the high-pressure environment. For example, some antihistamines cause behavioral changes—often unpredictable. The NMRI program includes a general pharmacologic study that has surveyed, in several species of animals and under hyperbaric conditions, the activity and toxicity of common therapeutic drugs such as aspirin, caffeine, antihistamines, anesthetic drugs, and antibiotics. Researchers are beginning to study ways the results of these studies can help Navy divers.

## HUMAN ENGINEERING

Several tasks have been designed to assess divers' underwater performance:

- the ENERPAC task, in which divers use a hand-operated hydraulic tool to cut into a wire roll.
- a task in which divers maneuver a self-contained load-handling pontoon under water.
- An underwater pipe puzzle assembly task developed at the University of California in Los Angeles (UCLA).
- the $SP^2$ task—NMRI's revision of the UCLA pipe puzzle.

These tasks were used in the early 1970's to measure divers' performance during evaluations to determine whether the U.S. Navy prototype Mark XII diving system (see cover) was a suitable replacement for the standard Mark V diving system, used since 1930.

Human engineering considerations can also provide much-needed information about the impact of diving equipment and systems on the diver's safety and performance. For example, during the evaluations of the Mark V and Mark XII diving systems, a biomechanical analysis was performed on divers wearing each suit (*9*). This analysis employed 14 biomechanical measures taken from dynamic anthropometry (which deals with range of motion and joint angle changes), and helped pinpoint the restrictions and limitations of the two diving suits.

Human engineering assessments of tools and hyperbaric systems are also under way at NMRI. The use of alternate work systems, such as one-atmosphere diving systems and manipulators, will be explored as possible ways to meet the Navy's goals for deep dives.

Divers and occupants of hyperbaric chambers depend on their life-support systems to provide a pure and physiologically adequate breathing medium. It is therefore important to identify those toxic contaminants that are most likely to cause debilitating or irreversible effects on diving personnel. It is equally important to determine the specific biochemical, physiological, and pathological changes in diving personnel exposed to such contaminants under hyperbaric conditions. While standards exist for long-term exposure to contaminants in submarines, it is not yet known whether these standards are appropriate for hyperbaric environments. Toxicology researchers at NMRI will evaluate such toxic contaminants using animal models in hyperbaric environments. Valid standards for human exposures in hyperbaric operational systems should evolve from these evaluations.

Although man has been diving for centuries, little is known about the long-term and short-term effects of chronic exposures to high pressures and to the gases used in diving systems. As researchers define the effects of hyperbaric exposures on the various body functions and systems, they will also be looking for ways that mammalian systems can adapt or acclimatize to the high-pressure environment.

Outlined here are current problems being studied at NMRI. The research under way and planned may prove that these problems are not barriers to man doing useful work at great depths in the sea.

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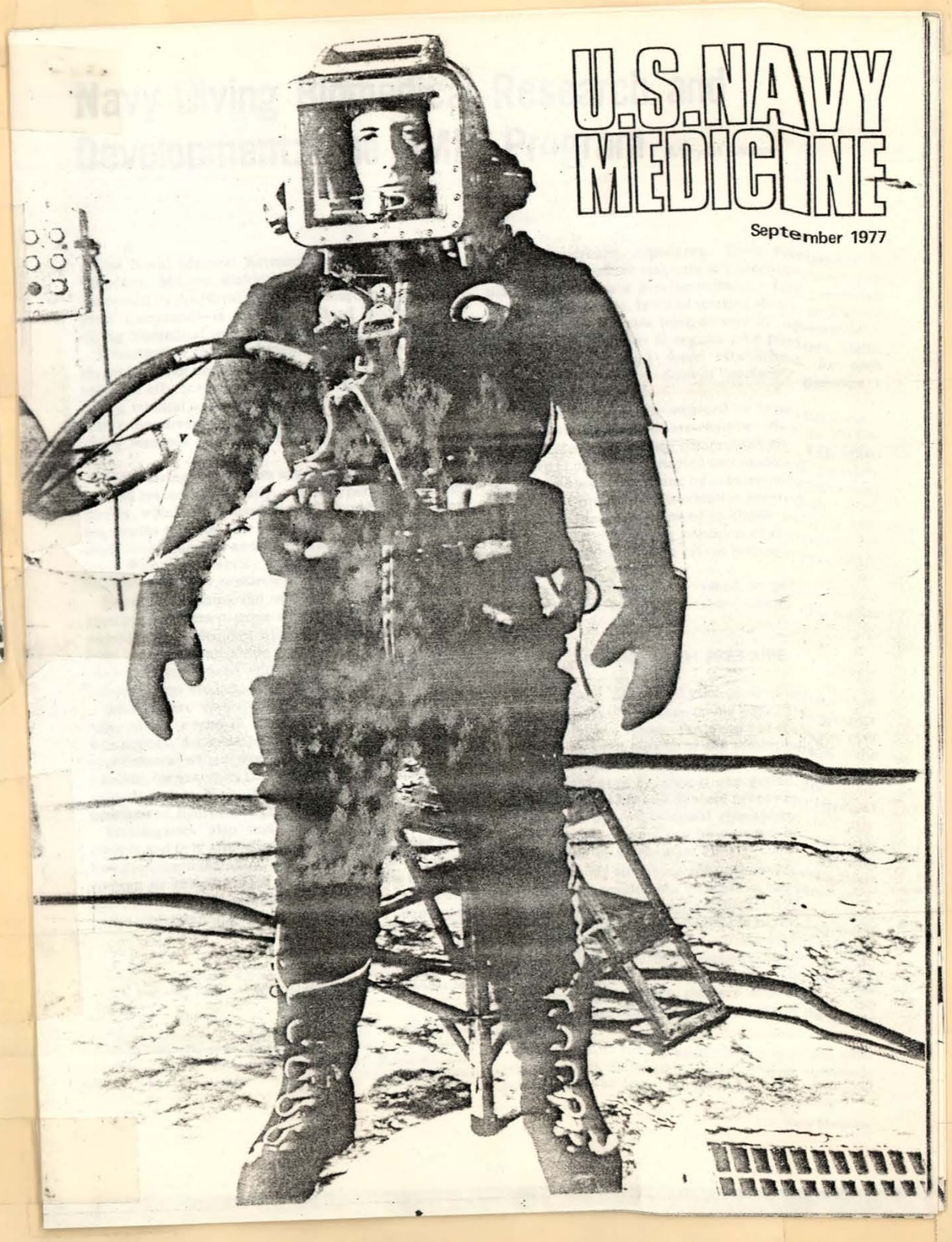
# U.S. NAVY MEDICINE

September 1977

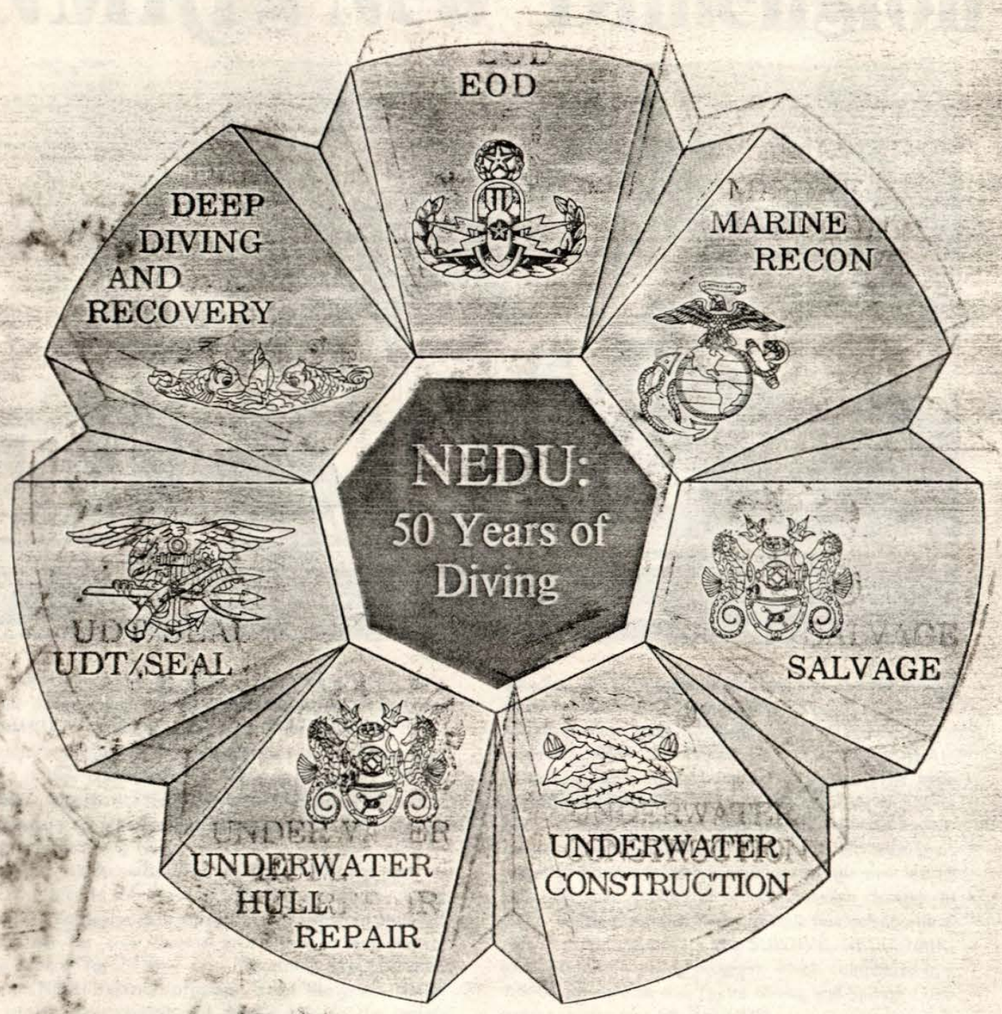


# U.S. NAVY MEDICINE

September 1977

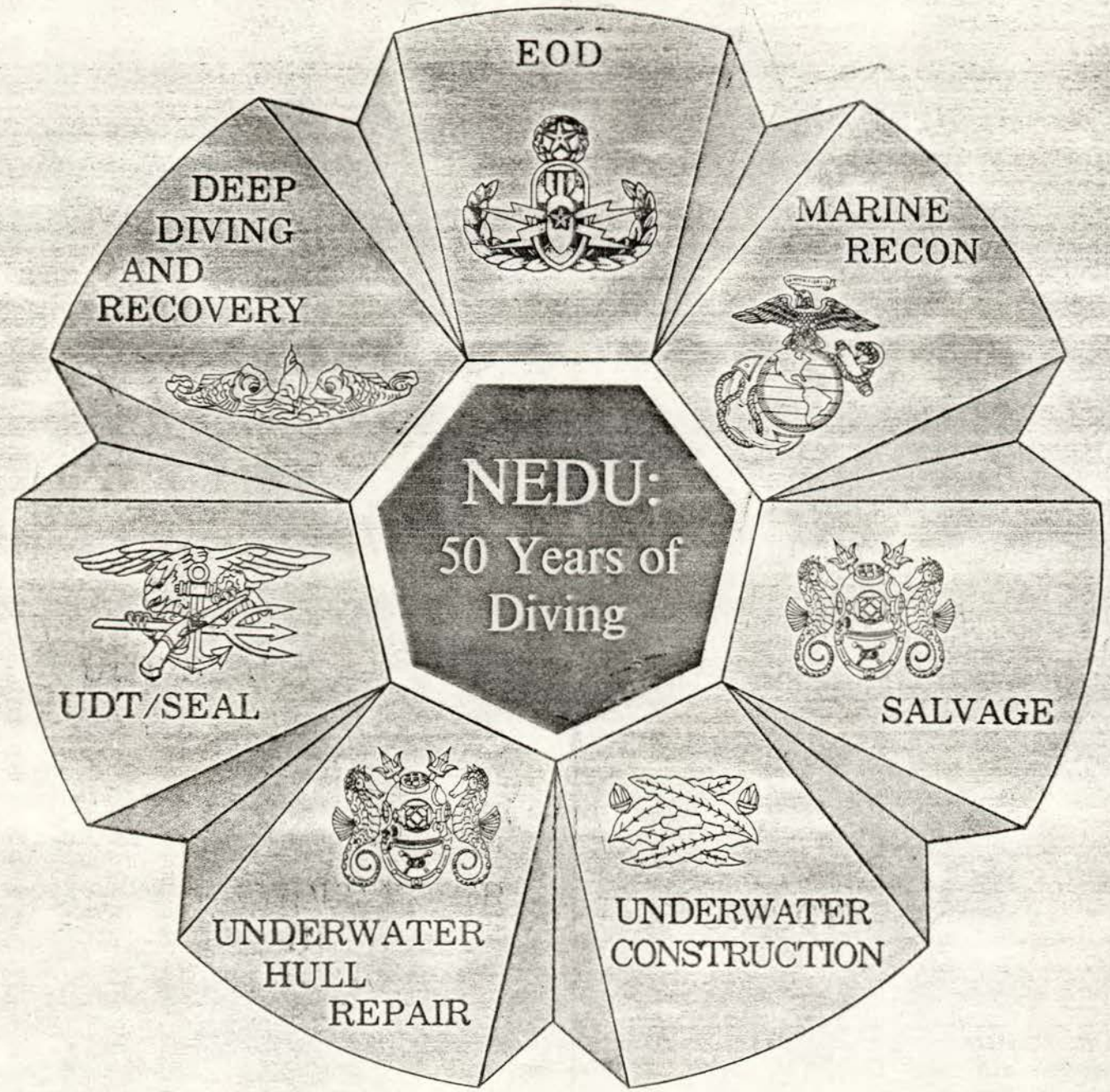
# FACEPLATE

FALL 1977



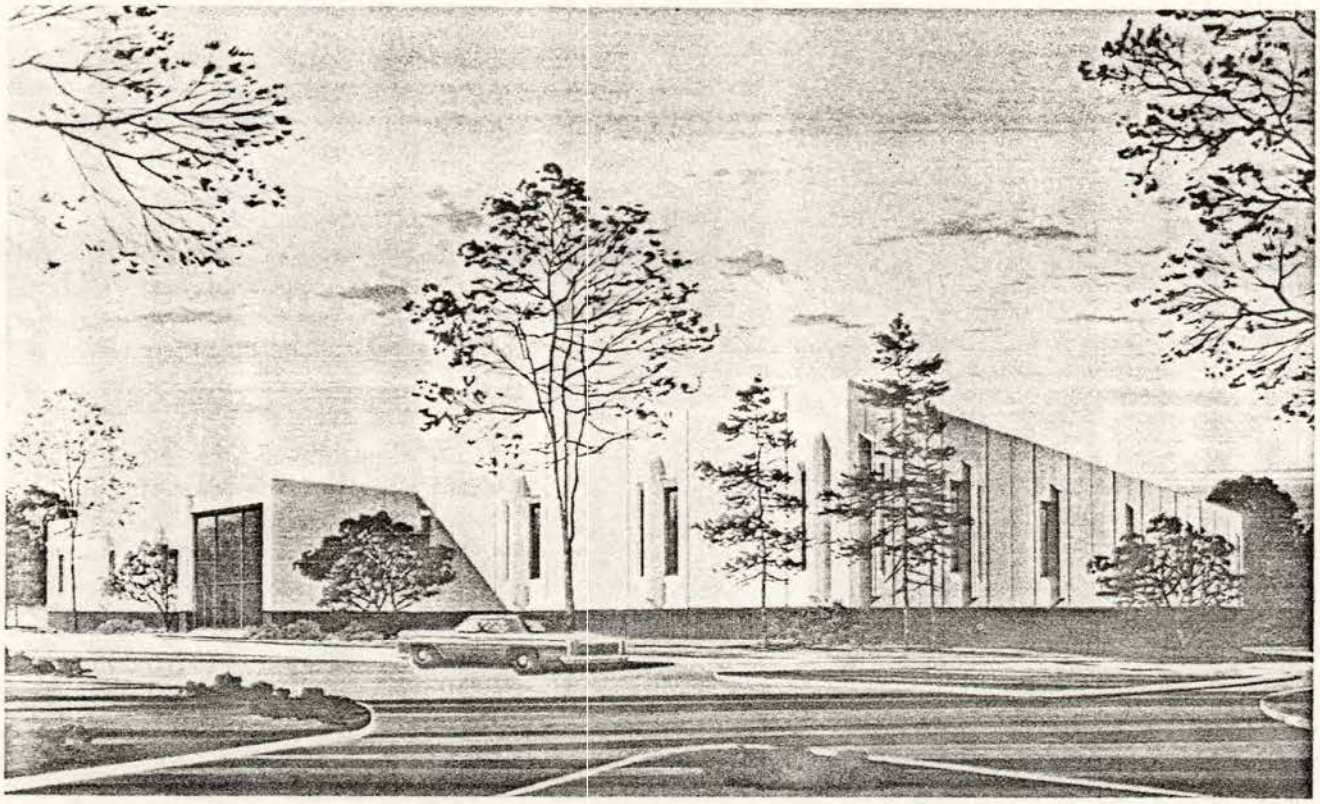
# FACEPLATE

FALL 1977



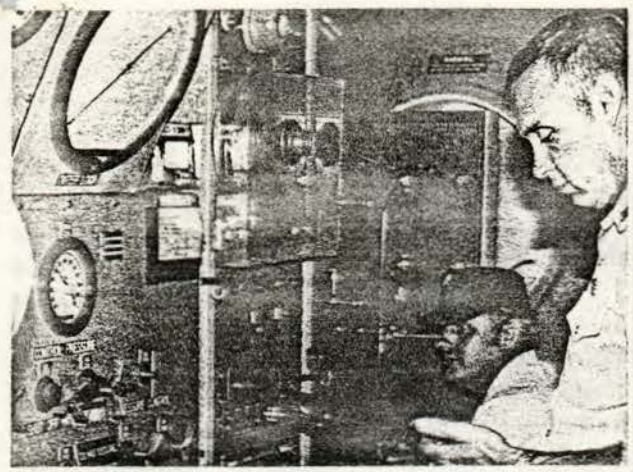
LCDR Scott Stevenson, CEC, USN
Mr. John Nacquin
*Naval Medical Research Institute*

# NMRI's New Dimension

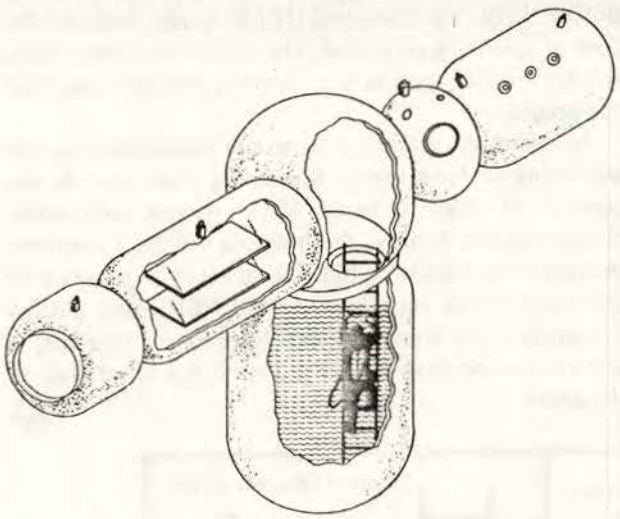


The Navy's diving research program is taking on a new dimension at the Naval Medical Research Institute (NMRI) in Bethesda, Maryland. This dimension is the addition of a diving biomedical research capability with the unique combination of research scientists, sophisticated hyperbaric facilities, and operational personnel necessary to provide deep diving medical research support to the diving Navy.

Since its commissioning in 1942, NMRI has been an active force in the world of Navy diving medicine. Early and continuing work in the area of cold stress has provided guidance for diver thermal protection. In fact, the requirement for heating diver breathing gases resulted from NMRI research programs. Over the years, NMRI scientists have contributed significantly to the understanding of decompression sickness and of other aspects of diving medicine by conducting basic and advanced research in these areas. NMRI physiologists and behavioral scientists were active participants in the SEALAB, TEKTITE, and MAKAI habitat programs. (The basic saturation tables for SEALAB III were developed at NMRI.) More recently, working with the Navy Experimental Diving Unit (NEDU) and others, NMRI researchers provided human factors evaluations of the new Mk 12 hard hat that resulted in beneficial design changes. In 1973, NMRI personnel were principle research coordinators and participants for the SUPDIVE, NEDU, NMRI joint saturation diving program, which culminated in a 1,600-foot dive in the Taylor Diving and Salvage Company complex (see *FP*, Fall 1973).



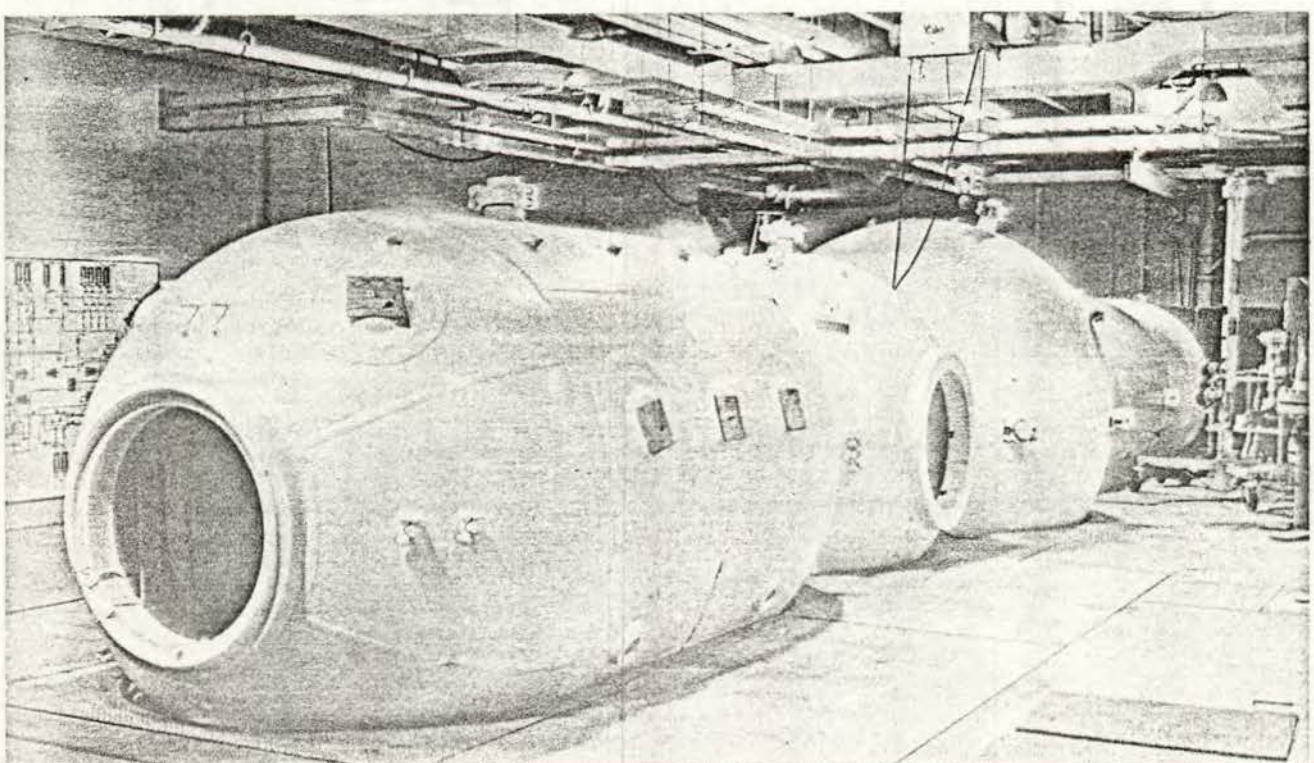
ENCM(MDV) Winters (standing) and HT1 Seeley at the controls of NMRI's 750-foot depth capability chamber complex.



Above: Artist's concept of new complex. Photo below shows basic chamber structure of new complex installed thus far.

Today, NMRI is engaged in an expanding diving research program with basic scientific work in thermal stress, respiratory and cardiovascular response, toxic contaminant effects, decompression theory, decompression sickness, underwater performance, hyperbaric biology, and hyperbaric microbiology. Before the advent of deep saturation diving, NMRI relied primarily on its 750-foot chamber complex (vintage 1938) for most manned research. This facility was recently certified and is still serving the Institute well. In recent years, NMRI has participated heavily in deep diving experiments using NEDU and civilian facilities. However, as previously reported in *Faceplate* (Spring 1976), NMRI is soon to acquire its own major hyperbaric research facility, one that is unequaled in depth capability within the United States Navy. The opening of this facility, scheduled for the summer of 1978, will add an in-house capability to conduct diving research far beyond our current deep diving limitations.

Called the Environmental Health Effects Laboratory (EHEL), the new facility consists of separate complexes of man-rated and animal chambers with a pressure capability of 1,500 psig, or approximately 3,400 feet of seawater. In addition, extensive laboratory spaces are available. The man-rated chamber complex consists of five horizontally mounted chambers with a wet pot connected below the central chamber "igloo". The system includes complete capabilities for atmospheric control using air, helium-oxygen, and other mixes. Wet pot water temperature can be varied down to 34°F (1°C). Gas farm, compressors, gas mixer, helium reclaimers, communications, video monitoring, computer links, and semi-automated diving control systems are also included. Table 1 provides more particulars.



MRCC STATISTICS

| CHAMBER | OUTER CHAMBER | RESEARCH CHAMBER | DIVING CHAMBER (dry) | DIVING CHAMBER (wet) | INTERIM CHAMBER | RESEARCH CHAMBER | SERVICE LOCKS |
|---|---|---|---|---|---|---|---|
| DIAMETER | 7 ft | 7 ft | 10.5 ft | 8.5 ft | 8 ft | 8 ft | 19 in |
| LENGTH | 8 ft | 14 ft | spherical | 11.6 ft | spherical | 15 ft | 22 in |
| WORKING PRESSURE | 1,000 psi | 1,000 psi | 1,000 psi | 1,000 psi | 1,500 psi | 1,500 psi | |
| DEPTH | 2,250 ft<br>685 m<br>68 atm | 2,250 ft<br>685 m<br>68 atm | 2,250 ft<br>685 m<br>68 atm | 2,250 ft<br>685 m<br>68 atm | 3,360 ft<br>1,036 m<br>103 atm | 3,360 ft<br>1,036 m<br>103 atm | |
| VOLUME | 260 ft³ | 504 ft³ | 562 ft³ | 555 ft³ | 262 ft³ | 658 ft³ | 3.8 ft³ |

NOTE: (1) The dry diving chamber service lock is 34" in length with a surface volume of 5.6 ft³ to facilitate equipment transfer.

(2) Water temperature in the wet diving chamber may be chilled to 34°F (1°C) or heated to 90°F (32°C).

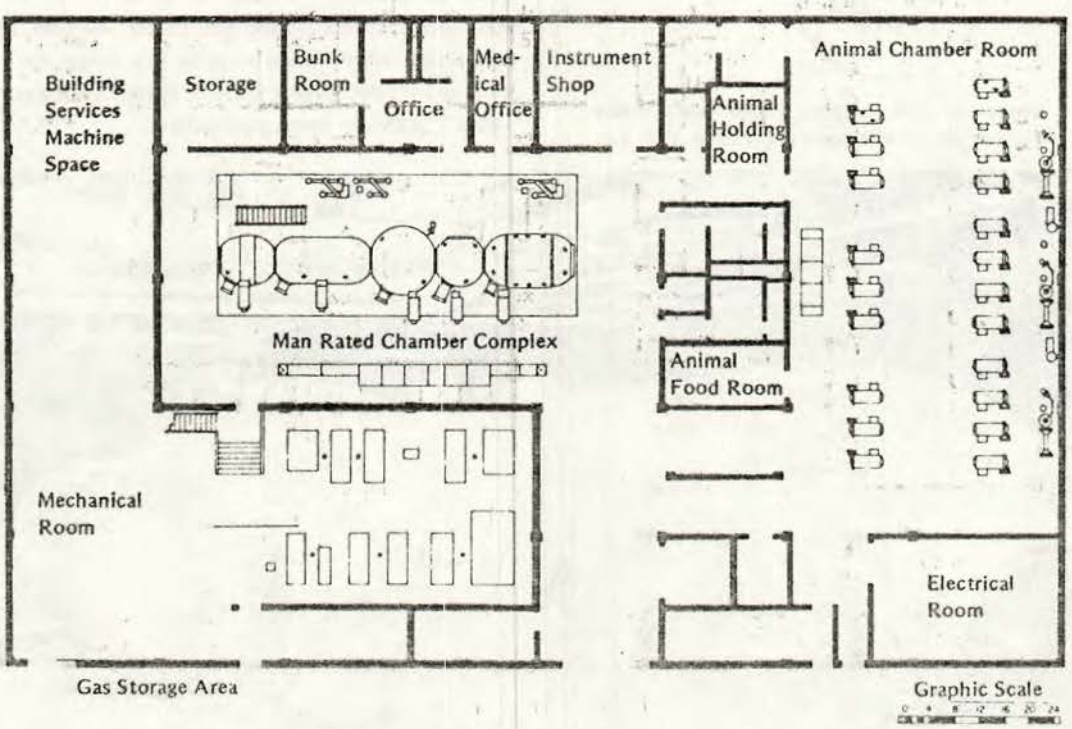
Table 1: Operational specifications for the man-rated chamber complex of EHEL.

The animal chamber complex includes 21 small animal chambers with life support capabilities equivalent to those of the manned complex. The complex is designed to conduct long-term studies of the effects of various toxic materials in hyperbaric environments. Basic studies in other areas of diving will also be conducted. New diving concepts will be tested on animals before manned dives are attempted.

Currently, the construction of the EHEL has progressed to the point where all chambers are in place and a considerable amount of piping has been installed. The gas farm is nearly complete. During the coming months, the compressors, gas supply systems, control panels, and associated equipment will be installed. Completion is expected in mid-1978, at which time NMRI will take full control of the complex. Then begin the tasks of unmanned and manned work-up dives, check in/out systems, and overcoming all those hurdles required to turn a new diving complex into an operational facility. If all goes according to plan, research in the man-rated complex will begin before the end of 1978.

Until next summer, NMRI will continue to monitor the construction, procure ancillary equipment, develop a trained staff of military and civilian divers, prepare operations and maintenance procedures, and procure and stock a spare parts inventory. Staffing requirements include 25 enlisted saturation divers in addition to the Institute's staff of diving medical officers, diving corpsmen, and civilian diver personnel. Currently, ENCM (MDV) W. Winters is the Command Master Diver; HTCS (DV) C. Gross, MMCS(DV) R. Brewer, HMC P. West, BMC(DV) R. Vandine, and HT1 R. Seeley make up the core of operating personnel. The remainder of the billets will be filled as soon as the "friendly detailer" can find the people.

In summary, NMRI, a long-time contributor to the well-being of Navy divers, is entering a new era. As the operator of what will be the Navy's newest and deepest diving research facility, the Institute will be a keystone in expanding the diving biomedical research program of the Navy. Close coordination with NEDU and civilian institutions will continue; and, by working together, it will be ensured that the Navy diver is the safest diver in the world.




Floor plan of EHEL chamber operating spaces

# THE HAHN & CLAY ANVIL

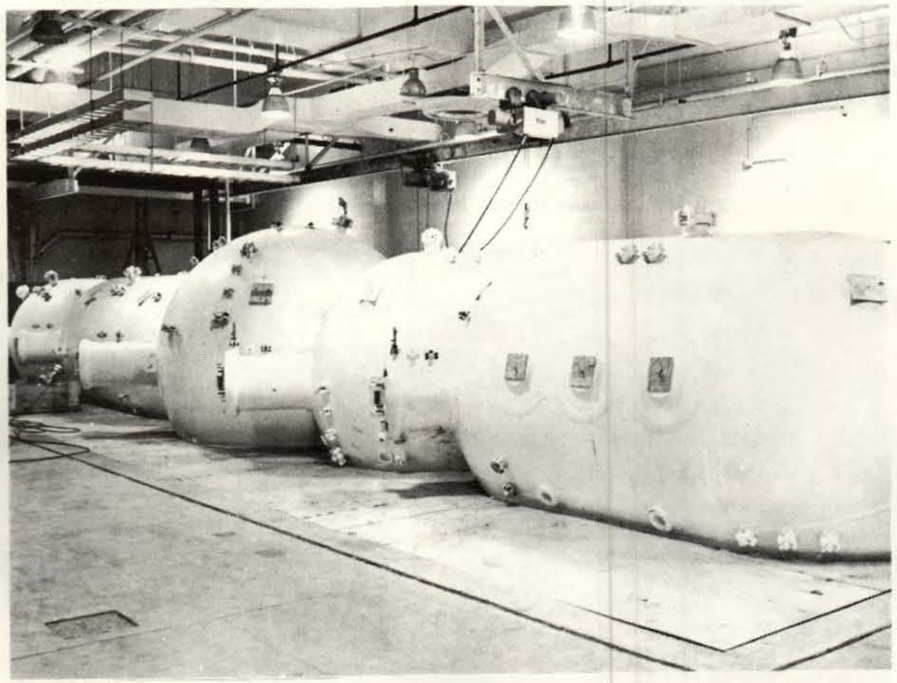
Houston, Texas

THE ANVIL VOL. X, NO. 10 OCTOBER 1, 1977

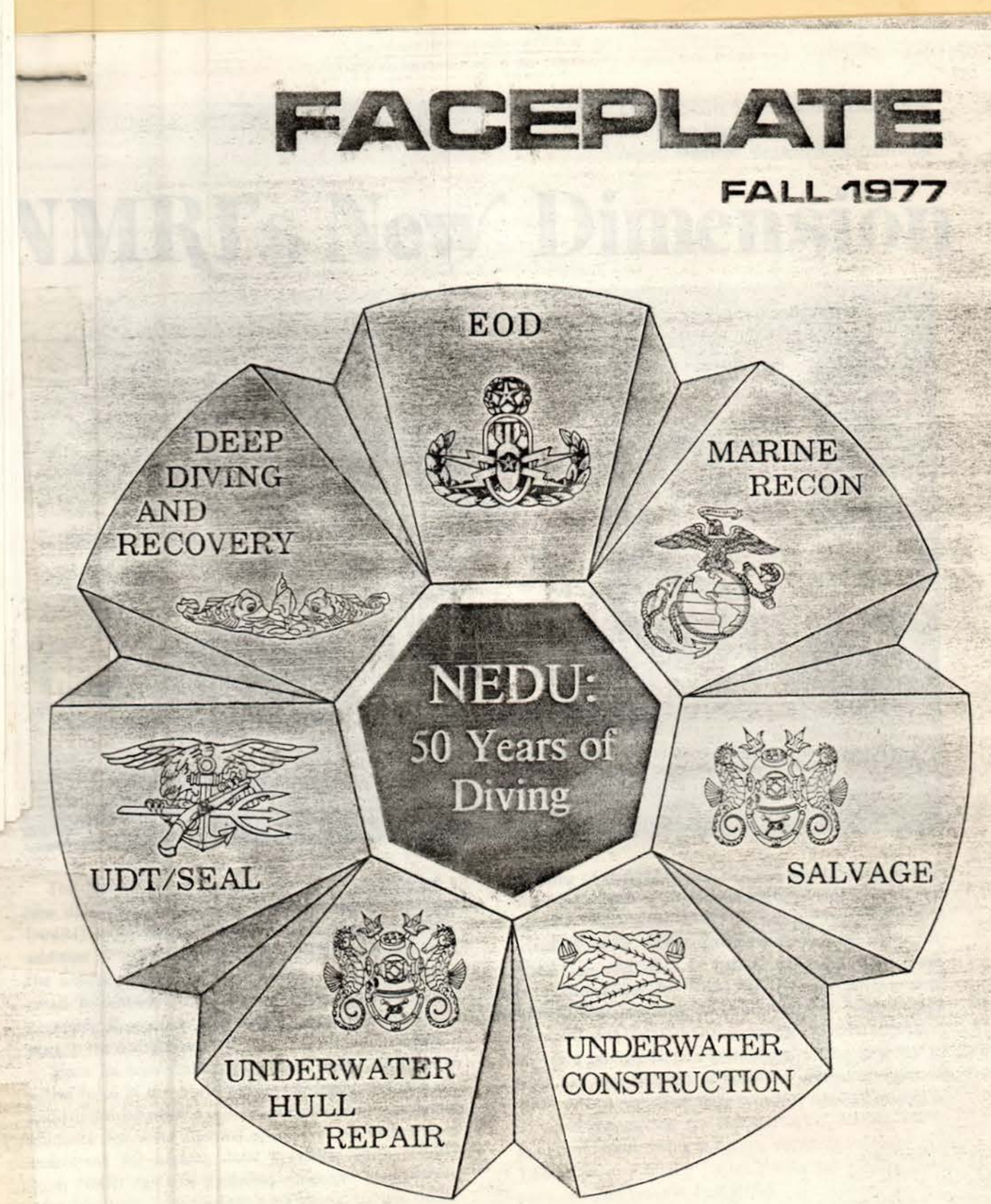

## 99700 FINALE

*by Larry Megow*

In the June, 1977 Anvil, you saw 99700 being installed in the brand new Naval Medical Research Laboratory at the U. S. Navy Hospital, Bethesda, Maryland.



This photo and the photo on page 2 show the installation completed. Our chambers are in the back . . . the two forward chambers were manufactured by a competitor. The mating of the two assemblies went together slick as a whistle.

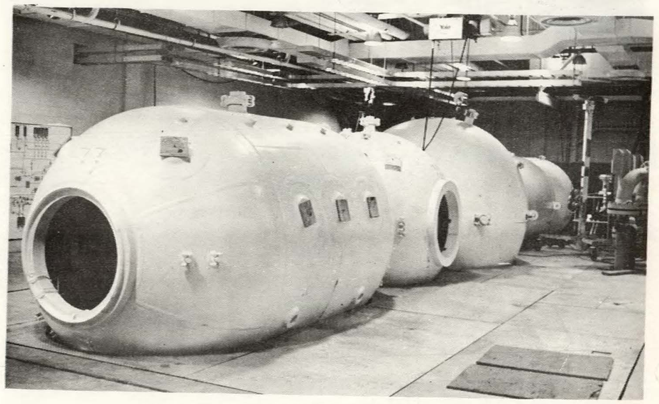


This beautiful little lady is Lana Cheri Commiato, daughter of Pete and Becky. She was two months old when the picture was taken and was four months old September 10. Lana is the first born child in the Commiato family. You can find her father, Pete, in the Machine Shop, days.

Pictured above is J. D. Clifton's granddaughter, Lauren Angelina Sauceda, who was born September 11, 1977. Lauren came into this world weighing 5 lbs. 13 oz. and was 20½ inches long. Now, you really can't blame J.D. for being so proud, can you?

## 99700 FINALE

*(continued from Page 1)*



*The completed installation . . . Job 99700.*



# JOB OF THE MONTH

## NO. 21011

### "ROUND THE CLOCK"

by

*LARRY MEGOW*

Around August 11, 1977 Don Martine came sailing in from Beaumont and said, "You think we can retube a boiler in ten (10) days?" Of course, the answer was, "Yes, but . . . ".

Yes, but . . . we should know a little about the job. Like what size and how many tubes? Do we need to make new tube sheets? Does it have any baffles?

The answer was, "I don't know, we'll find out when the boiler gets here Friday, August 12, 1977".

*Photo #1 - Gene Woodruff and Bill Blackard standing on the docks. Woodruff says, "What's this?"*

*Blackard replies, "It's a boiler, wonder what we're supposed to do with it and where we're going to set it down?"*

The job did come in, and on August 12, 1977 (See Photo #1). After a preliminary inspection, it was found that . . .

- All the (576) 1 1/4" 12 gage, A-178-A, 20' long tubes would have to be replaced, but the customer had the tubes in stock.
- We would have to cut out both tube sheets and make new ones from 5/8" plate.
- Tubes would have to be rolled and welded on both ends (See Photo #2).

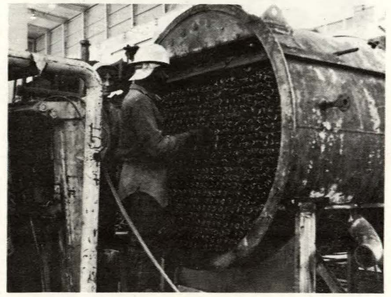
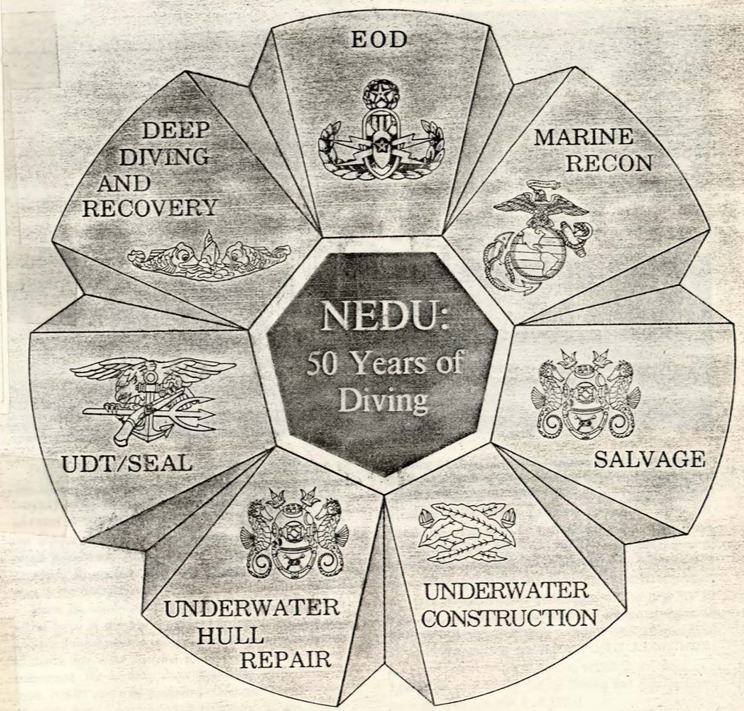


*Photo #2 - Don Westbrook and Charlie Hall have just finished cutting out the front tubesheet after having burned the (557) tubes loose. You'll have to look hard for Bill Tengler.*

*(Continued on Page 4)*

# FACEPLATE

**FALL 1977**



## "Round The Clock"

*(Continued from Page 3)*

- We would have to replace (35) 2" tubes, each one had to be bent at a different radius. These tubes had to be welded on both ends (See Photo #3), and

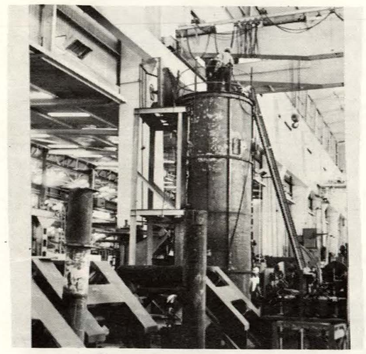


*Photo #3 - Re-assembling the (35) 2" bent tubes is Charles Hall. Tommy Platt is close by seeing that the tubes get assembled in the matching holes.*

- Re-test the boiler, and when we got ready to test, it was found that the manhole cover was an opening ball size and we had none to fit. Fortunately, the customer had a cover (See Photo #4).

On August 25, 1977, the completely repaired boiler left our plant exactly on the day it had been promised.

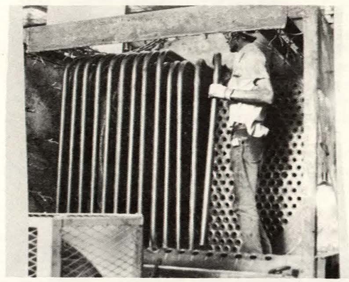


*Photo #4 - Tadeusz Zaremba and James Cross on top finishing the tube welding and Chester Pillard getting the boiler ready to hydro test.*

Little Valerie's homework was to learn a new word each day.

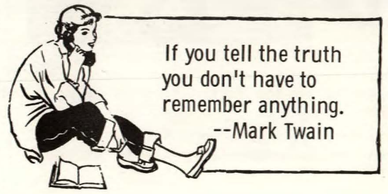
She chose "pregnant". When she asked her mother what pregnant meant, her mother said, "Pregnant means carrying a child."

Next day at school she gave the class her new word - pregnant. Then the teacher said, "Very good, Valerie, now use your new word in a sentence."

Valerie pondered a moment, then said, "The fireman ran into the burning house and came out pregnant."

TIME OUT

FOR A LITTLE WISDOM






# "SAFETY" IS THE WORD!

### Candidate For The "Wise Owl" Club

by

*Mike Clay*

Today Roger Casares is one who takes his 20/20 vision dead serious and is quite thankful, also, for such a gift that is all too often taken for granted.

On September 8, 1977 around 1:00 P.M., Roger became a victim of an unforgettable accident that very well could have been a serious injury if he had not been wearing his safety glasses.

Roger, a two month Hahn & Clay employee who is working as a boilermaker in Department #6, explains that it just happened over a simple operation of chipping slag while preparing a 6-G weld. That's right . . . and all it took was a slight rap of a hammer sending a piece of blinding slag hurtling straight in the path of his left eye, completely shattering the left lens of his safety glasses.

*Roger Casare's safety glasses, after a piece of slag flew up and shattered the left lens. If Roger had not been wearing these glasses, he surely would have suffered severe damage to, or possibly the loss of, his left eye.*

Roger, because of his belief in safety glasses, has earned a lifetime membership in the "Wise Owl of America Club". Along with this honor, Roger will be presented with a certificate and gold "Wise Owl" award.

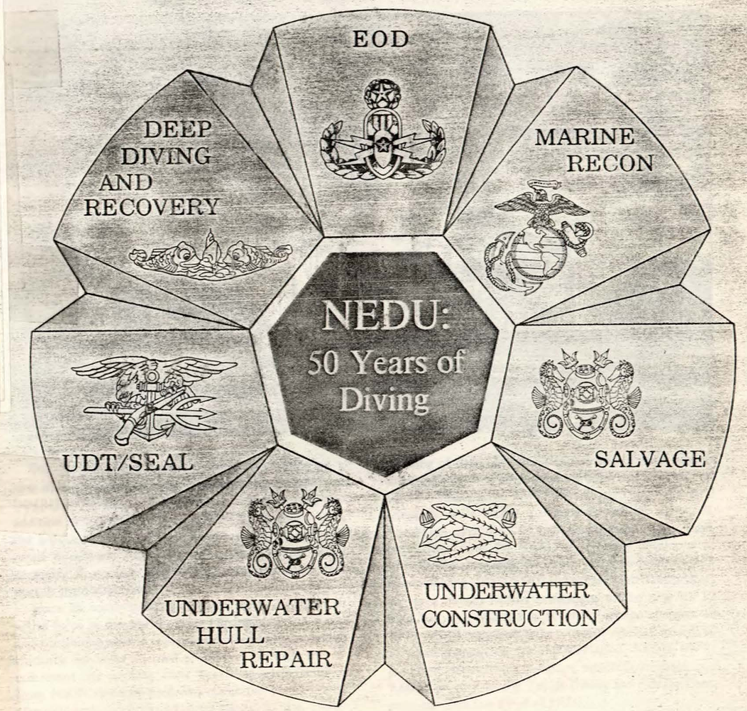
*Roger Casares at work . . . a candidate for the "Wise Owl" Club.*

If you ever see Roger at work, the chances are that you will see him as a safety conscious man. If you have the time, ask him what he thinks about his 20/20 vision. He can tell you how much it pays to be safe. Elsewhere on this page are two pictures. One of Roger in action and one is a close-up of Roger's glasses, after the accident. See what kind of a help safety glasses can really be?

May we all congratulate Roger on a job well done and hope that others will continue to follow in his footsteps.

# FACEPLATE

**FALL 1977**



# LIFE LINES
OR
HAVE YOU HEARD THE LATEST?

by

*Barbara Roth*
*and*
*Billie Sommer*

Congratulations to J.D. and Lorrene Clifton who became grandparents for the first time last month. Their new granddaughter was born September 10th and her name is Lauren Angelina Sauceta. See her picture on Page 2. J.D. says he and Lorrene are really looking forward to their new job of babysitting and spoiling Lauren . . . Earl Blair returned to work September 14th after undergoing surgery at Parkway General Hospital in August. Glad to have you back, Earl, and hope you are feeling good . . . Vernon Manes, Fabricating Department, returned to work September 14th after attending funeral services in California. Vernon lost his father August 28th. Vernon's mother also passed away in July. Everyone extends their deepest sympathies to you, Vernon, on your great loss . . . Welcome wishes go to Rick Anderson, Production Control Department. Rick has just moved here from Pittsburgh, Pennsylvania in hopes of a warm winter. We all hope he will not be disappointed . . . Happy Birthday wishes to Robert Kieschnick who celebrated in early Sept. Robert has started another beard and is patiently waiting for the deer season to open. For all the newcomers at Hahn & Clay, Robert keeps his beard every season until he gets a deer then celebrates by shaving it off. Usually though, as luck would have it, Robert is still sporting the beard when New Year's Day rolls around. We'll all have to watch him for results this season . . . William Skyeagle spent the Labor Day Holiday in Parkway Hospital for tests. He's back with us now and feeling much, much better . . . Frank and Adeline Hallisey spent a week vacationing in El Paso, Texas. Frank says he went to the dog races while Adeline did some shopping. Frank reports that he had a great time and must have done pretty good because he spent less money than Adeline. What he doesn't realize is that it's supposed to work that way . . . Henry Kominczak spent a week of his vacation at Chapel Hill. Henry participated in some of the local festivities and went to the Community Bazaar . . . Wallace McClellan was with us for a couple of weeks in September. Wallace helped out in the collection and pledges for United Fund . . . Harry Wratten took a week of vacation and went fishing at Rollover Pass. We hear that he had a very successful catch . . . Burt Kilmer and his wife took a 5 day Caribbean Cruise recently and report that they really had a great time! They flew to Florida, where they boarded their Cruise Ship. They stopped at St. Thomas in the Virgin Islands, and several islands in the Caribbean . . . Lou Romatowski took his vacation last month and although we don't know exactly what he did, we heard he enjoyed the change of pace . . . Thomas Martinez spent a week in Mexico where he visited some friends . . . Happy Birthday to Dave Scott. Dave turned 27 in September. You can find Dave working in the Engineering Department.

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FOR SALE

2 nice, oversized, shaded lots in Junction, Texas, 14 X 72 - 1971 mobile home with central a/h, two full baths, under-pinned. All furnished, ready to live in. 2 new metal out-buildings 1, 14 X 14 and 1, 20 X 14 - carport 14 X 40. Backporch - very nice, $18,500. or will trade for equal value in property. If interested, write to:
J.A. Denton
14327 Angus Dr.
San Antonio, Texas 78247
or see
Helen Pate in Accounting.

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Congratulations to the following men who have worked hard to earn their promotions:

*Joe Mattern, our new General Welding Foreman.*

*Glenn Tarkington has moved from nights to be our new day shift Fabrication Foreman.*

*Glenn Bartee has moved into the position of Assistant Foreman on the night shift.*

# MOVED

In June, 1957, Howard "Shorty" Jennings came to work at Hahn & Clay and gave us the benefit of his experience for more than twenty years.

Shorty's duties ranged from fitter to foreman, providing a great many contributions to Hahn & Clay over the years.

Shorty left us September 2, 1977 and will be working in College Station, Texas in the Maintenance Department at Texas A&M.


*Howard "Shorty" Jennings, left, receiving his going away gift from Joe Mattern.*

As a token of appreciation, Shorty was presented with an anniversary clock bearing the inscription (on a gold placque) "To Howard "Shorty" Jennings, From your co-workers, September 2, 1977". Pictured above is Shorty receiving his gift from Joe Mattern.

We all wish Shorty the best of luck and success in his new job. We will miss him at Hahn & Clay.

# NEWCOMER

*Rick Anderson is working in Production Control. Welcome Rick! See Life Lines for details.*

Pictured above is Melissa Kay Quinton, daughter of "Tool Room Jim" and Beverly Quinton. A neighbor and friend of Melissa's liked the picture and sent it to Provine Studios in Alexandria, La. It was chosen, from among many, to represent school pictures taken by Provine Studios. Melissa's picture will be shown in Texas, Louisiana, New Mexico, and North Midwestern States. Melissa is 10 years old.



## William Victorian Jr.

## INJURED

Word has been received that Sgt. William Victorian Jr. was seriously injured while on a classified assignment for the U.S. Marine Corps. Being a secret mission, full particulars are scarce, but it is known that three men died at that time and Sgt. Victorian is hospitalized, with serious radiation burns on the face and head. He was taken to a hospital in Colorado and later flown to a hospital in San Diego, where he is at this time.

On his release from the hospital, Sgt. Victorian will receive a medical discharge, if he so wishes.

We will be looking forward to a visit from William. He is the son of William and Maxie Victorian and the grandson of Willie James.

*Michael Spring, grinding out defects on the 9" casting on Job 21131.*

## BOWLING NEWS

The 1977-1978 bowling season started on September 7th and 8th as Hahn & Clay Team #1 and Team 32 began league play.

Team #1 bowls on Wednesday nights in the Esquire League at Merchant's Park Lanes. The team is composed of Ron Megow, Robert Kieschnick, George Perez, Gene Woodruff, Bill Merryman and Charlie Driscoll (substitute).

Although the season is only three weeks old, there have been some noteworthy scores. George Perez had both high game and high series with 225 - 158 - 203 = 586; Ron Megow had a series of 556 and a 507; Robert Kieschnick had a game of 200 even; Gene Woodruff had a 521 series and Bill Merryman had a 507 series.

Team #2 bowls on Thursday nights in the Gulfgate Commercial League at Gulfgate Lanes. The team is composed of Donald Raines, Adam Ely, Genaro Isaac, Hilton Pillard, Earl Franklin, Gene Woodruff (substitute) and Dick Clay (substitute). High for the regular team members last week was Earl Franklin with a 180 game and a 463 series.

---

He who gets too big for his breeches, will be exposed in the end.

---

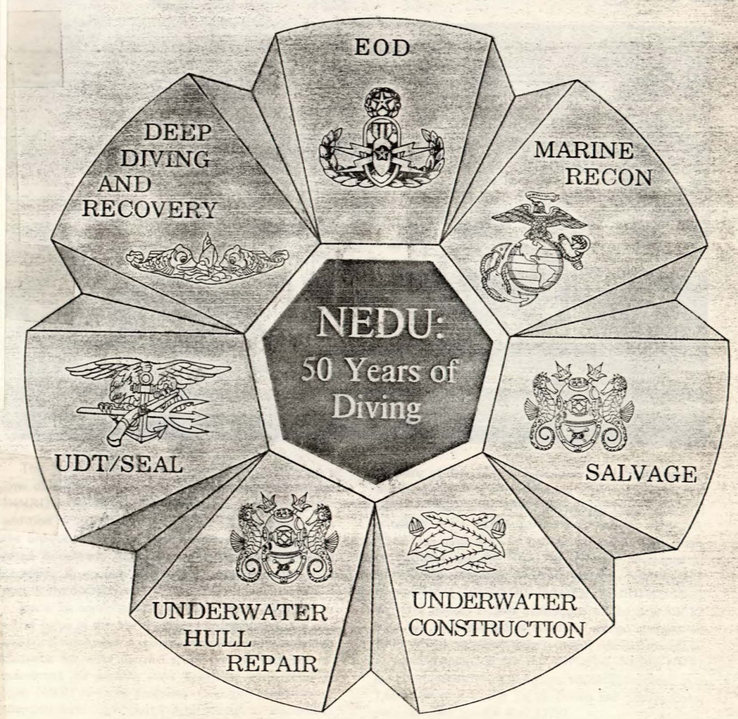
Ed says sales pitches are like steer horns . . . a point here, a point there and a lot of bull in the middle.

---

Kermit says there are some who think that hardening of the arteries is a highway project.

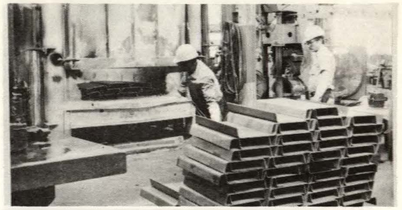
# FACEPLATE

FALL 1977



# Johnnie Straka's Crew Forms A Batch Of Hose Racks

*Jessie Manley positions the heated blanks in the small press. Chester Pillard ready to remove the finished rack.*



*Jessie Manley and Gene Periera stacking 3/16" pre-bent blanks in the small furnace.*

*Except for galvanizing and drilling some holes, these hose racks are ready for some customer.*

*You can't see him, but you can be sure that Johnny Straka is watching the furnace and counting the finished racks.*

## We Have A New Page . . .

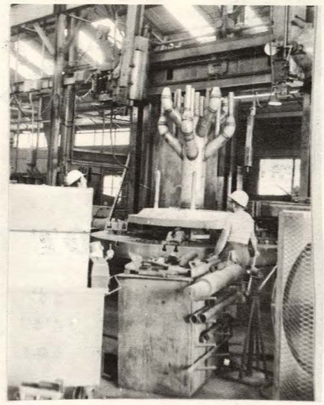
Each month we will feature an "Anvil" page, illustrating Hahn & Clay's major machine tool capacities. You will find the first machine capacity, vertical boring mill, in this issue on the back page.

When you have read your Anvil, tear off the last page and file it for future reference.

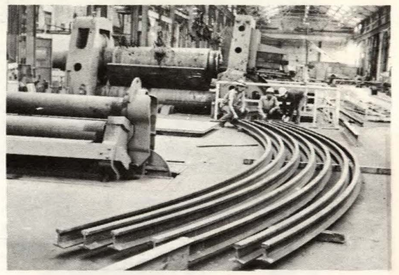
If you have any suggestions for featuring future machine capacities, contact Larry Megow.



# HAHN & CLAY AT WORK



*FANCY STAINLESS STEEL CHRISTMAS TREE - Job #21195 - The base of this fancy tree, called an injection nozzle, is being machined by Meyers and Marshall.*



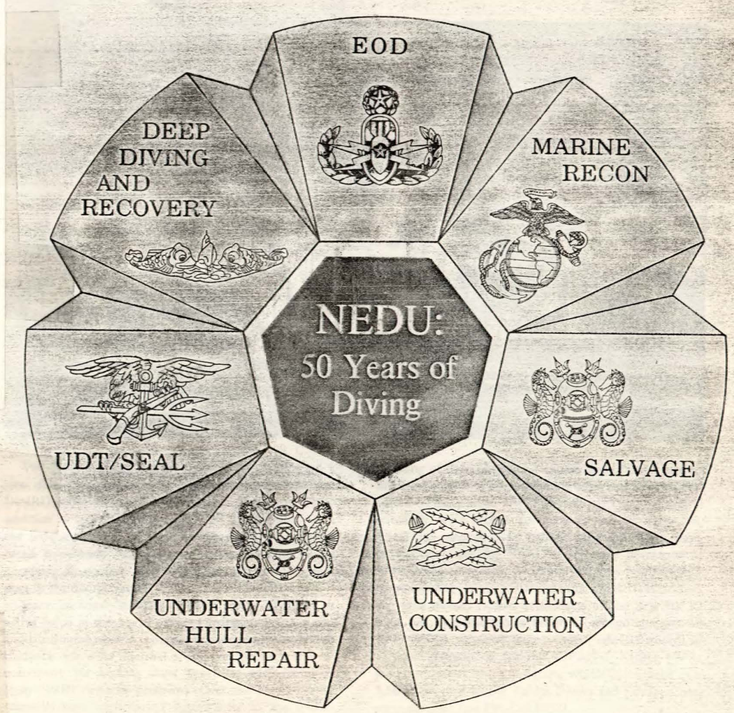
*RAILS - Job #21116 - Floyd Kimich, John Saucedo and Leon Kimich finish forming half a dozen (40') 90# rails to a 39' 6½" radius. Rails will be used to re-build a turntable.*

*CLEANING UP - An important part of our operation is to keep the plant clean. Here's Willie James doing just that - cleaning up.*

*CONCENTRATION - Genaro Isaacs machining a very narrow "O" Ring groove.*

# FACEPLATE

FALL 1977



OTC 3283

# A FACILITY AND PROGRAM FOR DIVING BIOMEDICAL RESEARCH

by H. S. Stevenson, U. S. Medical Research Institute



This paper was presented at the 10th Annual OTC in Houston, Tex., May 8-11, 1978. The material is subject to correction by the author. Permission to copy is restricted to an abstract of not more than 300 words.

DISCLAIMER

The opinions and assertions contained herein are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Dept. or the naval service in general.

ABSTRACT

A new deep-diving research facility is being constructed at the Naval Medical Research Institute, Bethesda, Md. The facility is known as the Environmental Health Effects Laboratory (EHEL). The EHEL consists of a man rated chamber system, 12 research laboratories, and 21 small animal chambers. The man rated and animal chambers are capable of simulating depths to 3,400 ft. A computer system is included also. The EHEL, together with a growing staff of research scientists and engineering support personnel provide the essential elements for a comprehensive program of basic science and advanced development in diving biomedicine.

The EHEL will be used in support of a scientific program directed toward (1) solution of current U. S. Navy diving operational problems that are biomedical in nature; (2) understanding the nature of physiological and behavioral phenomena encountered during currently achievable operational deep dives (1,000 to 1,500 ft); and (3) demonstrating man's capability to function at deep depths (target 2,500 ft). The program involves interrelated efforts in performance, thermal balance, respiratory and cardiovascular functions, hyperbaric toxicology, decompression, oxygen toxicity, and hyperbaric microbiology.

## INTRODUCTION

During the past decade there has been tremendous advancement in diving technology and equipment. Further significant advancement in technology for deep diving is contingent upon understanding the human limitations imposed by pressure and how these limitations may be overcome by controlling the diving environment. The Navy and the diving industry must continue to eliminate these deficiencies if we are to appreciate fully man's capability to perform useful work in the ocean.

For many years the Navy has been an active participant in diving research at Navy laboratories and at various commercial and university laboratories. Today the frontiers of diving technology have progressed to such depths that few research organizations maintain the sophisticated and costly chamber systems required to support state-of-the-art deep-diving research. In view of this, the Navy is constructing, at the Naval Medical Research Institute, a new hyperbaric research system that will provide a full range of diving research environments for man and animals. This facility is known as the Environmental Health Effects Laboratory (EHEL). Completion of construction is scheduled for June 1978. This paper presents a general description of the EHEL, a more detailed description of the man rated chamber system, and an outline of the program of diving biomedical research at the Naval Medical Research Institute.

## EHEL DESIGN AND CONSTRUCTION

### General

The EHEL is being constructed under the management of the Chesapeake Div., Naval Facilities Engineering Command. Design was accomplished by Sanders and Thomas, Inc. The hyperbaric systems are being installed by John C. Grimberg Construction Co. The facility is a two-story structure with offices, 12 separate scientific laboratories and computer room on the upper floor. The lower, or operating floor, is divided into three areas as shown in Fig. 1. These are the man rated chamber complex (MRCC), the animal chamber room, and the gas supply mechanical room.

The MRCC is depicted in Figs. 2 and 3. The complex consists of five interconnected chambers with a wet chamber located beneath the large spherical central chamber or igloo. Three of the

References and illustrations at end of paper.

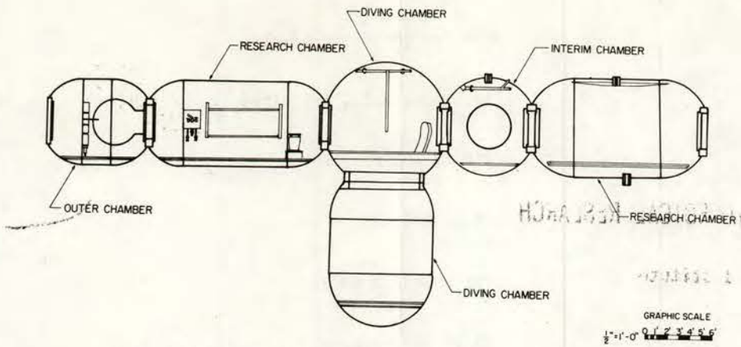



FIG. 2 - CONFIGURATION SKETCH OF THE MAN RATED CHAMBER COMPLEX.

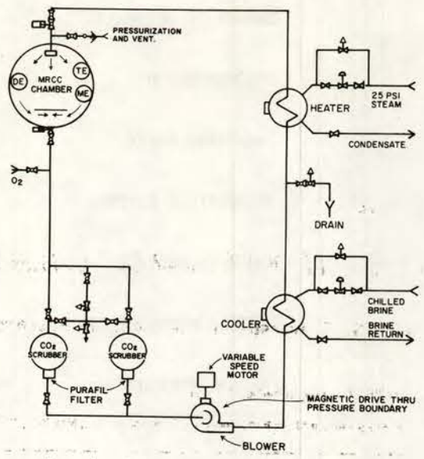



FIG. 4 - SIMPLIFIED DIAGRAM OF TYPICAL EHEL ATMOSPHERIC CONDITIONING SYSTEM.

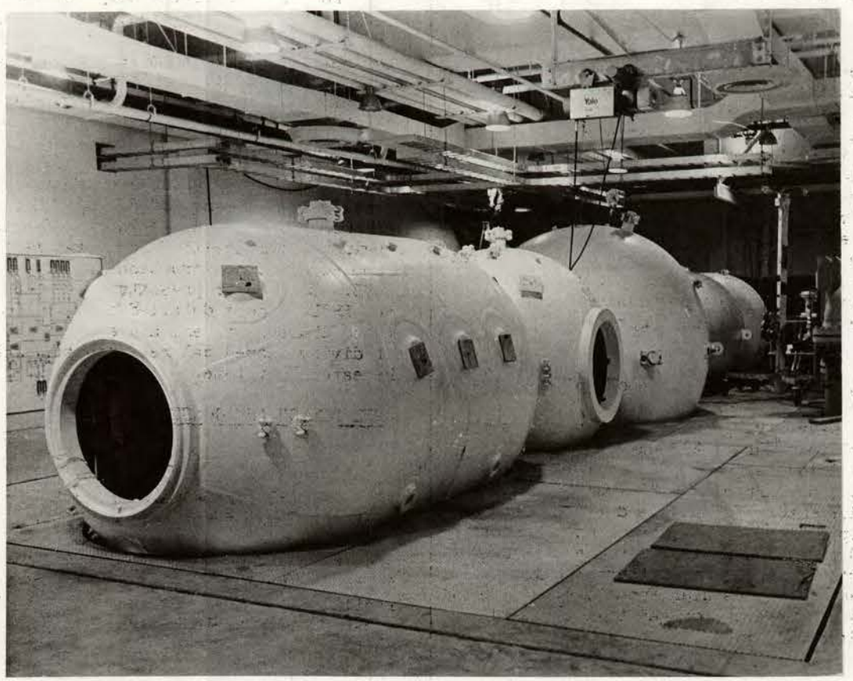


FIG. 3 - MAN RATED CHAMBERS IN PLACE BEFORE ASSEMBLY OF LIFE SUPPORT PIPING.

OFFSHORE TECHNOLOGY CONFERENCE

OTC 3283

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Performance assessments are often the indicators of equipment on physiological problems and limitations. To understand and overcome diving performance limitations coordinated research into sensory, cognitive, and motor function, task taxonomy, human factors engineering, performance physiology, and drugs is required. The phenomenological and physiological aspects of high-pressure nervous syndrome (HPNS) are included in the performance research program. The question of the effect of high pressure on the action of various drugs is one for which there is little authoritative information.

### Toxic Containments in Diving

NMRI hyperbaric toxicology studies are directed toward evaluating the effect of elevated pressure on the action of known toxic compounds and to the determination of safe hyperbaric exposure limits for compounds that may be encountered by divers. The program includes assessment of the compounds likely to become pollutants of diving environments. Extrapolation of normobaric personnel exposure criteria to hyperbaric conditions is one goal.

### Oxygen Toxicity

Safe and efficient diving demands the utilization of increased oxygen pressure while avoiding its toxic effects. The oxygen toxicity work is aimed at two principal objectives: first, to develop the capability to measure the threshold changes in pathology to organs that result from high-pressure oxygen exposures. This includes quantification of the development, severity, and rate of recovery from varying degrees of oxygen toxicity. Second, the research will attempt to identify the factors that modify hyperoxic response in man that possibly may lead to identification of methods to decrease the toxic effects of hyperbaric oxygen.

### Hyperbaric Biology

Tasks in high-pressure biology address the basic neuromuscular mechanisms at extremely high pressure as an aid to examining such problems as high-pressure nervous syndrome (HPNS), the effects of drugs on divers, and the pathology of decompression sickness and cerebral air embolism. Specific objectives include the determination of the molecular mechanism in HPNS, and an understanding of the effect of high-pressure gases on control mechanisms in tissues and peripheral nervous systems.

## CONCLUSION

This paper has attempted to present the diving community a timely and accurate description of the U. S. Navy's newest diving research facility and the diving biomedical research program for which it will be used. The EHEL represents a diving research capability that, today, is far ahead of man's depth capabilities. Prudent and carefully planned use of the EHEL, along with other diving research systems, world-wide, is the only way to realize the full potential of man under the sea and to reduce the physiological hazards of diving.

It is noted that the various tasks discussed in the descriptions of the research program categories are exemplary in nature and do not represent the depth or breadth of medical research that is foreseen for a comprehensive program of diving research. The program is of a long-term nature and will continue to evolve as diving technology advances.

## REFERENCES


1. White, E. L., Boyd, W. K., Doershuk, D. C., Bartilson, B. M., and Coyle, A. J.: "Corrosion of Carbon Steel Components of Atmosphere Conditioning Systems in the Environmental Health Effects Laboratory," summary report by Battelle Columbus Laboratories for NMRI (Dec. 9, 1977).


TABLE 1 - ENVIRONMENTAL HEALTH EFFECTS LABORATORY MAN RATED CHAMBER STATISTICS

| CHAMBER | OUTER CHAMBER | LIVING CHAMBER | DIVING CHAMBER (dry) | DIVING CHAMBER (wet) | INTERIM CHAMBER | RESEARCH CHAMBER |
|---|---|---|---|---|---|---|
| DIAMETER | 7 ft | 7 ft | 10.5 ft | 8.5 ft | 8 ft | 8 ft |
| LENGTH | 8 ft | 14 ft | spherical | 11.6 ft | spherical | 15 ft |
| WORKING PRESSURE | 1000 psi | 1000 psi | 1000 psi | 1000 psi | 1500 psi | 1500 psi |
| DEPTH | 2250 ft<br>685 m<br>68 atm | 2250 ft<br>685 m<br>68 atm | 2250 ft<br>685 m<br>68 atm | 2250 ft<br>685 m<br>68 atm | 3360 ft<br>1036 m<br>103 atm | 3360 ft<br>1036 m<br>103 atm |
| VOLUME | 260 $ft^3$ | 504 $ft^3$ | 562 $ft^3$ | 555 $ft^3$ | 262 $ft^3$ | 658 $ft^3$ |

However, whenever pure oxygen is used, it will be supplied through the BIBS.

### Gas Supply System

The EHEL gas farm provides for storage and supply of air, oxygen, helium, nitrogen, and mixed gases for the MRCC and animal chamber systems. It also provides for temporary storage of contaminated gases and for reclaiming helium. The system includes 96 storage flasks with internal volumes of 26.87 $ft^3$. Storage of all gases except oxygen is at 4,600 psig. Oxygen will be stored at 3,000 psig. Of the 96 flasks, there are 51 helium, 9 oxygen, 5 nitrogen, 6 air, 16 mixed gas, and 9 impure helium. Nine flasks (6 helium and 3 impure helium) are devoted to the animal chambers. The remainder support the MRCC chambers.

There is sufficient MRCC helium storage to pressurize the MRCC chambers to rated pressure 1.5 times. An additional reserve of helium will be available in tube trucks. MRCC oxygen supply is designed to provide a six-man crew with metabolic oxygen requirements plus losses for up to 90 days.

The system includes one 2,200-psig, 50-scfm air compressor, two 2,250-psig, 50-scfm helium and mixed gas compressors, three 4,600-psig, 50-scfm general service compressors, and one 3,000-psig oxygen compressor. All are water cooled and electrically driven. Compressors were supplied by AMINCO.

The gas mixer, built by NAVTEC Industries, is designed to mix up to three gases. Any percentage of oxygen can be obtained. A Teledyne 225B helium and two Teledyne 326A oxygen analyzers are incorporated. The mixer will deliver up to 160 scfm of mix depending upon inlet and outlet pressures.

There are two helium reclaimers in the EHEL. One serves the MRCC system. The other serves the animal chamber systems and has been modified for removal of trace contaminants that will be injected artificially into the animal chambers during experiments. Both are cryogenic separation-type units.

The configuration of the gas system has been designed to be as flexible as possible. The compressors and the gas mixer are connected so that any compressor can be "patched" into any bottle bank by simple hose connections, which are all located at the gas farm control station in the EHEL machinery room. The use of such a system simplifies the piping and eliminates the possibility of cross-bank contamination due to valve leakage.

### Communications

Communications between the diver subjects and control personnel are provided by three separate voice systems and by television monitoring in each chamber. The open intercom, with a speaker-microphone in each chamber, will provide primary communications whenever unscrambling is not required. Three helium unscrambled voice channels will be provided on a headset system. Two or more headsets will be installed in each chamber. The helium unscrambler and associated chamber communications were manufactured by Divers Unlimited. The third mode of voice communications is a sound powered phone system that is provided for emergency purposes.

The closed-circuit television system will provide visual monitoring in each chamber. Seven cameras and seven monitors are provided. Video and audio recorders are planned.

### Environmental Monitoring and Control

Control and monitoring of the MRCC chamber environments is accomplished through a system of status and control panels located in the MRCC area. Five separate local control consoles, located immediately adjacent to the chambers served, provide for individual manual pressurization, venting, and depressurization of each chamber. The fire suppression system and sanitary flushing systems also are controlled from the local consoles.

Along one wall of the MRCC area are located the main MRCC status and control panels. A gas farm panel has gauges that display the pressure in each of the 30 separate banks of gas storage bottles that serve both the MRCC and animal chamber systems. This panel also provides a schematic for monitoring gas farm valve line-up. The gas analysis panel provides a means to monitor the gas composition in the chambers. Carbon dioxide content of the chamber gases is monitored on a continuous basis by Beckman Model 865 nondispersive infrared analyzers. Continuous monitoring and control of oxygen content is provided by polarographic analyzers, which are integral to the oxygen make-up systems. In addition, the gas analysis system includes separate Teledyne Model 322X paramagnetic oxygen analyzers as back-up and check instruments. A permanent record of the concentration of carbon dioxide for each chamber is available from an integral time identifiable multipoint recorder, located on a panel adjacent to the analyzer panel. A gas chromatograph/mass spectrometer will be available for synoptic trace gas analyses. Appropriate computer interfacting will be available to allow immediate availability of chamber gas constituent data for experimental computations. The system incorporates a high carbon dioxide alarm for each chamber, and high and low audible oxygen alarms for each paramagnetic analyzer. The gas analysis system is capable of analyzing all gases stored in the facility on a periodic basis by patching to quick disconnects on the panel from hand-carried sampling cylinders.

Future provisions will be made for permanent recording of chamber temperatures, pressures, humidity, and oxygen content. Closed circuit video and audio-communications recording equipment will be available.

The central area of the main console is made up of five separate and similar MRCC control panels (one for each chamber) and a central subsystem status panel. Each control panel contains all of the switches and valve controllers to set and operate the life-support ACS loop lined up to the associated chamber. Oxygen content, carbon dioxide content, temperatures, and humidity are all controlled from these panels. Other controls such as fire suppression, BIBS, and gas supply system valves also are located on these operating panels. Video monitors

are incorporated. The central status panel provides the diving supervisor with essential pressure information for all gas systems on line and for the functional subsystems of the MRCC. The intercom and headset master stations are located here also. There are intercom and headset stations at each of the main operating and local panels.

MRCC Chamber Interiors

Primary living accommodations are supplied in the MRCC 1000. Four bunks, toilet, and sink are in MRCC 1000 living chamber. Additional bunk space is provided in the dry diving (igloo) chamber. A curtained shower is provided in the igloo. Communications, BIBS, and fire extinguishing piping are in each chamber. The chamber interiors will be lighted by light tubes with the source mounted outside. Electrically controlled and interlocked valves control the sanitary drains and the venting of the holding tanks into the building sewer systems.

The igloo has a steel deck between it and the wet pot with ladder access into the wet pot. A diving gas manifold and hose racks are in the igloo, as is a wench for lowering equipment into the wet pot.

The interim and research chambers of the MRCC 1500 basically are free of nonessential equipment and thus will be ideal for experimental use while the other end of the complex is better suited for eating, sleeping, and other functions.

Wet Pot Systems

The MRCC wet pot provides wet simulation of deep ocean depths. Water in the wet pot is filtered and conditioned to any temperature between approximately 34°F and 100°F. Water depth will be approximately 10 ft. Diver entry and exit will be by ladder through a diving hatch in the deck of the igloo chamber. There is no pressure boundary between the wet pot and the igloo. Diver gas is supplied to a manifold in the igloo. Provision will be made to supply hot water for diver heating during cold-water experiments.

Fire Extinguishing System

Each of the MRCC chambers is supported by an independent fire-extinguishing system. The systems are of the water-deluge type with overhead spray nozzles in each chamber. Water is stored in tanks at approximately 100 psi above chamber pressure. Activation control is manual from within or outside the chambers.

Assessment of Carbon Steel Pipe in the EHEL

To the author's knowledge, the EHEL is the first major man rated hyperbaric system to employ carbon steel piping in its life-support systems. Normally stainless steel is used. However, as a cost-saving measure, an early decision was made to use carbon steel pipe in the ACS loops and the chamber breathing gas supply piping. Potential problems relating to this decision were identified as: (1) possible loss of sufficient pipe wall thickness to meet code requirements over the 20-year design life of the facility; (2) valve and component failure as a result of iron oxide dust and flakes in the system; and (3) contamination of the breathing gases with iron oxide dust. To determine the nature and extent of problems that the EHEL operators might expect, a study was completed by Battelle Memorial Institute.[1]

Assumed atmospheric conditions in various sections of the ACS loops were used to determine the most likely corrosion reactions and corrosion rates in each. Available data indicate that a general corrosion rate or loss of wall thickness of about 7 mils per year can be expected near atmospheric pressure and about 100°F in air. A 10-percent surface roughing or pitting factor also can be applied to account for uneven attack.

The analysis confirmed that the highest corrosion rate will occur in the water trap area between the ACS cooler and heaters. This section consists of an upright U-shaped section of 10-in. nominal Schedule 80 pipe with a drain tube and valve at the bottom of the U. This is the point where condensed water is collected and periodically vented to a drain. An average corrosion rate of 9.8 mils per year was determined for this section. Under the conditions expected in this water trap section, it is estimated that 0.56 lb of loose rust will be produced per year per square foot of pipe surface. Rust produced in other sections of the loops will range from 0.4 to 0.29 lb/year/sq ft. It is estimated that during the first 6 months little loose rust will be released into the system. However, after approximately 6 months, loose rust production will come into equilibrium with the corrosion rate and large quantities of rust will be in the system.

The Battelle predictions indicate that the piping in the EHEL life-support loops will meet ANSI B31.1 code requirements for wall thickness for service to 1,500 psi for the estimated 20-year life of the facility. Using the code methods, the time required for the corrosion to reduce the wall thickness to the minimum allowable for a maximum working stress of 20,000 psi was calculated. Pipe lives ranging from 19.6 to 26.7 years were predicted depending upon pipe size and corrosion environment.

The effect of the loose rust in the system is not assessed easily. Sealing problems are predicted after about 1 year in ball valves located in vertical pipe runs. This is because corrosion products will collect on the valves and score the seats as the valves are turned. Other ball valves are expected to experience increased maintenance requirements as well.

Rust dust in the system is not expected to create a physiological hazard to the operators since the gas entering the chambers is vented through a 5-micron filter. However, periodic cleaning of rust from the loops is anticipated.

In summary, the use of carbon steel pipe in the EHEL life-support loops results in increased surveillance and maintenance requirements. Periodic cleaning of the life-support loops, servicing of valves, and visual or ultrasonic pipe wall thickness tests will be required to ensure safe and functional systems.



HYPERBARIC OPERATIONS

The EHEL is intended to accommodate the needs of the NMRI scientific staff and collaborating researchers for hyperbaric environments in which to conduct diving research. To achieve this, a staff of qualified military and civilian diving personnel is being assembled at NMRI. Twenty-five enlisted saturation trained divers will form the core of the operators. Civilian technicians and artificers will provide maintenance continuity and will augment the operations staff. Medical staffing will be provided by the research staff of NMRI.

Upon completion of the construction, and functional checks of all hardware, a series of unmanned and manned workup trials will be conducted. This will allow the operators to gain confidence in the facility and it will serve as a training period. The workup trials will be completed in approximately 1 year, at which time a demonstration dive to a simulated depth of 1,000 ft is planned. During the workup period, research using the manned systems will be accomplished when compatible with the operational tests being performed. After achievement of this initial operating capability full-time research usage of the facility will begin.

RESEARCH PROGRAM

The hyperbaric systems of the EHEL will support an expanding interdisciplinary program of diving biomedical research. The program is directed toward the following general objectives: (1) provide timely solution to diving biomedical problems currently identified as fleet operational problems; (2) further develop biomedical technology and advanced procedures for the conduct of diving operations to currently achievable operational depths (1,500 ft); (3) advance the state of diving technology by developing methods for effective diving to greater depths and by demonstrating man's capabilities to perform at these depths. The initial target depth is 2,500 ft.

In such a program, it is necessary to keep a balance between research that will fulfill an immediate need and that which is directed toward new technology for the future. In areas where a specific immediate problem is identified, such as excessive bends incidence for a particular decompression schedule, a well defined development plan can be implemented. In areas where only a general objective can be stated, such as the achievement of 2,500-ft depths, research must proceed along a broad front. During the course of such exploratory research, problems may arise that are not foreseen and will need specific solution before further broad progress can be made.

Structuring a broad-based research program requires a matching of the objectives, the scientific disciplines required, and the talents of the scientific personnel involved. Taking these factors into account, the NMRI hyperbaric research program is separated into the following convenient categories: (1) thermal stress, (2) respiratory and cardiovascular response, (3) decompression principles and sickness, (4) performance, (5) toxic contaminants in diving, (6) oxygen toxicity, and (7) hyperbaric biology. The program includes approximately 90 individual studies. Many are ongoing; others will be initiated in the near future. The following discussions attempt to characterize the studies in each of the categories.

Thermal Stress

Ongoing NMRI research is examining the cardiovascular, pulmonary, and endocrinal response to thermal stress in the immersed diver. Studies are being initiated which will lead to the development of predictive equations for diver heat loss and supplemental heating requirements. These results will be tested in deep wet and dry saturation situations with full physiological monitoring.

These, among other thermal stress studies, are aimed at understanding fully the mechanisms of hyperbaric cold stress, providing means of predicting the diver's physiological response to cold, and to ultimately providing data and guidelines which can be used by equipment designers.

Respiratory and Cardiovascular Functions

The NMRI program of hyperbaric respiratory and cardiovascular function research is attempting to provide physiological data that will aid in the design and evaluation of breathing equipment and diving environments. Three broad goals are defined. First, a determination of the normal respiratory state to be expected of divers in a hyperbaric environment and, therefore, quantification of how immersion, pressure breathing, external breathing impedance, and dense gas alter the way in which the lungs and respiratory muscles function. Second, the effects on personnel safety, performance, and health, with respect to cardiovascular and pulmonary function, require assessment. Third, the program aims to determine the limits of ventilatory loading that a diver can tolerate and provide a rational basis for equipment design for deeper diving.

Decompression Principles and Sickness

All diving includes a requirement for some decompression procedure. The decompression research program consists of a mix of physiological and statistical investigations of decompression phenomena and schedules. The effort is directed toward development of decompression schedules, identification of the factors related to the cause and prevention of decompression illness, and development of treatment procedures for decompression illness and air embolism. This will require the use of small animals for quick and cost-effective evaluation of possible decompression related variables, the use of larger animals to confirm these results, and finally, the use of human subjects to proof-test the predictions developed during the animal studies. Specific tasks range from determination of optimal oxygen percentages and/or trimixes for accelerated decompression, to development of a predictive model for the risk of decompression sickness, to determination of the effects of decompression on blood supply to the bone.

Performance

The diving performance studies are aimed at making it possible for divers to carry out undersea work with little or no degradation resulting from the environment, techniques, or equipment.

five upper chambers and the wet chamber have a maximum working pressure of 1,000 psi, or approximately 2,250 ft of sea water. These are called the MRCC 1000 chambers. The other two chambers are capable of 1,500 psi, or approximately 3,400 ft of sea water, and are called the MRCC 1500 chambers. Recirculating life support is provided by three independent atmospheric conditioning systems. Each chamber has a local control panel located adjacent to it. A master control console, located along one wall of the chamber room provides control and monitoring capabilities for the MRCC. Unscrambled headset communications, open intercom, and sound powered phones are provided in each chamber. Through-viewport-television monitoring is available. The water in the wet chamber can be cooled to 34°F or heated to 110°F by means of a recirculating water conditioning system.

The 21-animal chambers of the EHEL are arranged in three banks of seven, with each bank serviced by an ACS similar to those used for the man rated chambers. The animal system will support long-term saturation studies on mice, rats, guinea pigs and rabbits to simulated depths of 3,400 ft of sea water. A toxic gas injection system is available on two of the banks for studies of the physiological response to various contaminants under pressure.

The gas supply system serves both the MRCC and animal chambers. The system includes gas storage flasks, air, oxygen and mixed gas compressors, a gas mixer, and separate helium reclamation systems for the animal and manned chambers.

All cooling heat exchangers are serviced by a single refrigeration system. Heaters use building steam service. Storage, shop, food preparation and watch-room spaces are included on the operating floor.

## Pressure Vessel and Piping Design

The MRCC and animal chambers are designed of HY-80 steel to ASME Section III criteria for Class 1 pressure vessels. Table 1 provides details on the size of each chamber. Each chamber includes a service lock, viewports, lighting penetrators, piping penetrations, and facility and experimental instrumentation penetrations. The two MRCC 1500 chambers are welded together, as are the three dry 1,000-psi chambers of the MRCC 1000. Bolted double O-ring joints connect the MRCC 1500 to the MRCC 1000 and the wet chamber to the diving chamber of the MRCC 1000. There are double interior chamber doors between all dry chambers to allow for operating any chamber combination at lesser or greater pressures than the adjoining chambers. Ingress and egress from the complex is through end doors or through a side door from the small interim chamber of the MRCC 1500 (see Fig. 2). The chamber assembly is supported by cushioned saddles near each end, and by two pedestals on either side of the central chamber. This configuration provides for stress relaxation as the chambers strain during compression.

The piping is designed and constructed to ANSI B31.1 requirements for service above 750°F. The 750°F requirement was used primarily as a means to require X-ray testing of welded connections. All atmospheric conditioning system and air and mixed gas chamber supply piping is A106B Schedule 80 carbon steel pipe. A discussion of the anticipated consequences of using carbon steel vs stainless steel life support piping is below. Gas farm, compressor, and gas distribution piping is Type 304 stainless steel. Oxygen piping is copper nickel above 1,700 psi and copper below that pressure.

During chamber fabrication and pressure piping installation, considerable attention has been given to quality assurance. The result is a high degree of confidence in pressure vessel and piping safety.

## Atmospheric Conditioning Systems

In the MRCC, breathing gases are supplied to the occupants by three possible modes, periodic venting to supply fresh gas, conditioning the gas and recirculating it, or through a mask or built-in-breathing system (BIBS). Traditional pressurization and periodic venting to remove $CO_2$ and replenish $O_2$ is available through local control panels at each chamber. This mode is suitable for shallow air dives. In most cases however, the breathing gas will be recirculated through one or more of the three atmospheric conditioning systems (ACS).

The ACS loops control carbon dioxide, oxygen, temperature, humidity, and contaminants in the chambers. Table 2 summarizes the basic ACS design criteria. Fig. 4 is a highly simplified schematic of one of the ACS loops. "Dirty" chamber gas is vented beneath the decking into piping and then to the ACS unit serving that chamber. $CO_2$ removal is accomplished by a sodasorb-filled canister on the suction side of the blower. In the canister, the gas also passes through a purafil bed to remove other contaminants. After passing through the blower, the gas passes through a cooling heat exchanger that cools it to below its dew point. A moisture trap is provided for periodic venting of water condensed out of the gas. The cooling heat exchangers are supplied with a 34°F propylene glycol-water "brine" as a cooling fluid. The cold saturated gas passes from the cooler directly into a heater supplied with 25 psig steam to heat the gas to desired chamber temperature and reduce the relative humidity. Upon leaving the heater, the gas is vented through a filter back into the chamber or chambers being served.

Redundant $CO_2$ canisters are provided so that a canister can be cleaned and recharged without shutting down the ACS. The blower is a "squirrel-cage" type fan mounted and baffled in a pipe tee. It is driven through a magnetic drive by a 8.3-hp motor. The unit is designed to provide 107 ACFM flow through the loop, which is approximately twice the flow required to maintain $CO_2$ concentration within acceptable limits. The magnetic drives eliminate pressure-retaining shaft seals, which have been troublesome in other deep-diving systems.

Automatic oxygen make-up is provided for each chamber. The oxygen is injected into the chamber exhaust gas upstream of the ACS $CO_2$ scrubber.

In addition to the recirculating ACS, loops breathing gases can be supplied to the chamber occupants through the BIBS located in each chamber. Normally this is an emergency system and would be used to provide a respirable breathing mixture should the chamber atmosphere become contaminated.

TABLE 2 - ENVIRONMENTAL HEALTH EFFECTS LABORATORY MAN RATED CHAMBER ENVIRONMENTAL VARIABLE CRITERIA CHAMBER CONDITIONS

| | |
|---|---|
| NUMBER OF OCCUPANTS | 6 MEN |
| MAXIMUM DEPTH | 3400 fsw (or state-of-art) |
| BREATHING GASES | Air, $HeO_2$, $N_2O_2$, tri-mixes |
| TEMPERATURE CONTROL | 70°F to 100°F |
| HUMIDITY CONTROL | 50% to 80% R.H. |
| PARTIAL PRESSURE $CO_2$ | Less than 3.8 mmHg. |
| PARTIAL PRESSURE $O_2$ | 100 to 350 mmHg. |

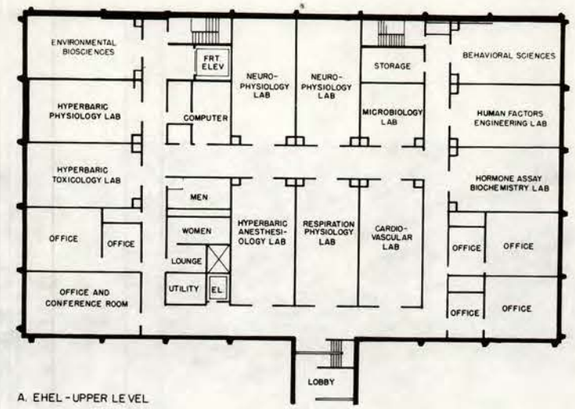
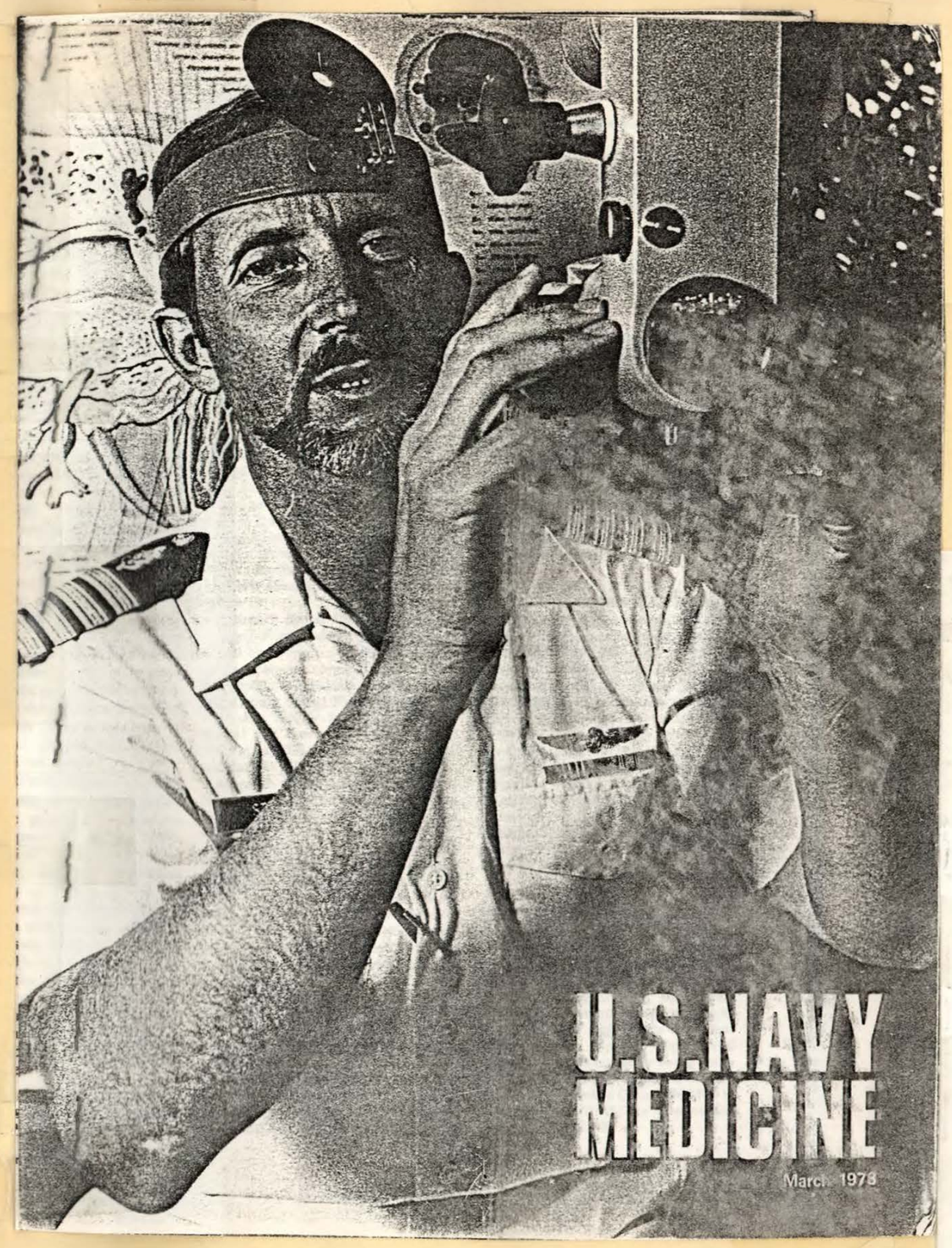



Fig. 1 - Floor plan of the Environmental Health Effects Laboratory.




OFFSHORE TECHNOLOGY CONFERENCE

OTC 3283

# A FACILITY AND PROGRAM FOR DIVING BIOMEDICAL RESEARCH

by H. S. Stevenson, U. S. Medical Research Institute



This paper was presented at the 10th Annual OTC in Houston, Tex., May 8-11, 1978. The material is subject to correction by the author. Permission to copy is restricted to an abstract of not more than 300 words.

DISCLAIMER

The opinions and assertions contained herein are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Dept. or the naval service in general.

ABSTRACT

A new deep-diving research facility is being constructed at the Naval Medical Research Institute, Bethesda, Md. The facility is known as the Environmental Health Effects Laboratory (EHEL). The EHEL consists of a man rated chamber system, 12 research laboratories, and 21 small animal chambers. The man rated and animal chambers are capable of simulating depths to 3,400 ft. A computer system is included also. The EHEL, together with a growing staff of research scientists and engineering support personnel provide the essential elements for a comprehensive program of basic science and advanced development in diving biomedicine.

The EHEL will be used in support of a scientific program directed toward (1) solution of current U. S. Navy diving operational problems that are biomedical in nature; (2) understanding the nature of physiological and behavioral phenomena encountered during currently achievable operational deep dives (1,000 to 1,500 ft); and (3) demonstrating man's capability to function at deep depths (target 2,500 ft). The program involves interrelated efforts in performance, thermal balance, respiratory and cardiovascular functions, hyperbaric toxicology, decompression, oxygen toxicity, and hyperbaric microbiology.

INTRODUCTION

During the past decade there has been tremendous advancement in diving technology and equipment. Further significant advancement in technology for deep diving is contingent upon understanding the human limitations imposed by pressure and how these limitations may be overcome by controlling the diving environment. The Navy and the diving industry must continue to eliminate these deficiencies if we are to appreciate fully man's capability to perform useful work in the ocean.

For many years the Navy has been an active participant in diving research at Navy laboratories and at various commercial and university laboratories. Today the frontiers of diving technology have progressed to such depths that few research organizations maintain the sophisticated and costly chamber systems required to support state-of-the-art deep-diving research. In view of this, the Navy is constructing, at the Naval Medical Research Institute, a new hyperbaric research system that will provide a full range of diving research environments for man and animals. This facility is known as the Environmental Health Effects Laboratory (EHEL). Completion of construction is scheduled for June 1978. This paper presents a general description of the EHEL, a more detailed description of the man rated chamber system, and an outline of the program of diving biomedical research at the Naval Medical Research Institute.

EHEL DESIGN AND CONSTRUCTION

General

The EHEL is being constructed under the management of the Chesapeake Div., Naval Facilities Engineering Command. Design was accomplished by Sanders and Thomas, Inc. The hyperbaric systems are being installed by John C. Grimberg Construction Co. The facility is a two-story structure with offices, 12 separate scientific laboratories and computer room on the upper floor. The lower, or operating floor, is divided into three areas as shown in Fig. 1. These are the man rated chamber complex (MRCC), the animal chamber room, and the gas supply mechanical room.

The MRCC is depicted in Figs. 2 and 3. The complex consists of five interconnected chambers with a wet chamber located beneath the large spherical central chamber or igloo. Three of the

References and illustrations at end of paper.

# UNDERSEA MEDICAL SOCIETY MEMBERSHIP



REPORT OF MEMBERSHIP COMMITTEE

Listed below are the New Members and Associates of the UMS, to whom we extend a most hearty, "WELCOME!"

## NEW MEMBERS

James M. Adam, Ph.D.
Aberdeen, Scotland

N.R.G. Badham, MB,Ch.B.
Whangarei, New Zealand

Mr. Richard W. Beaver
Wilmington, North Carolina

William J. Beel, Jr., M.D.
Clearwater Beach, Florida

John B. Berte, M.D.
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Boca Raton, Florida

David S. Wise, Ph.D.
New York, New York

## STUDENT MEMBERS

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Far Rockaway, New York

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APO San Francisco, California

Miss Vicki A. Vincenti
Wilmington, California

UNDERSEA MEDICAL SOCIETY
9650 ROCKVILLE PIKE
BETHESDA, MARYLAND 20014 U.S.A.







# PRESSURE

Newsletter of the
UNDERSEA MEDICAL SOCIETY, Inc.
(A NON-PROFIT ASSOCIATION)
9650 Rockville Pike Bethesda, Maryland 20014 U.S.A.
(301) 530-9225

Vol. 7 No. 4

An International Society: To provide a forum for professional scientific communication...[in] life sciences and human factors aspects of the undersea environment.

August 1978

*UMS TO BE GUEST SOCIETY AT APS FALL MEETING*

The 1978 Fall Meeting of The American Physiological Society will be held in conjunction with The American Society of Zoologists (Division of Comparative Physiology and Biochemistry), with the Undersea Medical Society as a guest society, at the Chase Park Plaza Hotel, St. Louis, Missouri. Registration is Sunday, October 22, 2-10 P.M.; Scientific Sessions Monday, October 23 through Friday, October 27. On Wednesday afternoon there will be a champagne tour of the city followed by cocktails and dinner on the Goldenrod Showboat. Also planned for Wednesday afternoon is a refresher course on Smooth Muscle Physiology.

Drs. Herbert A. Saltzman and Hermann Rahn have planned a symposium for Monday afternoon, October 23, on "Man as an Aquatic Mammal: Physiological Effects of Increased Ambient Pressure and Immersion." Papers will be presented by Drs. G. L. Kooyman, C. E. G. Lundgren, H. A. Saltzman, P. B. Bennett, and A. G. Macdonald. There will be discussion following each paper.

For advance registration forms and official forms for hotel reservations, write: The American Physiological Society, 1978 Fall Meeting Office, 9650 Rockville Pike, Bethesda, MD 20014.

## NOMINATIONS FOR UMS AWARDS

Dr. Eric P. Kindwall, Chairman of the Awards Committee, requests nominations for the four awards presented annually by the Undersea Medical Society. They are:

The Albert R. Behnke, Jr. Award, for outstanding scientific contributions to advances in manned undersea activity.

The Oceaneering International Award, for outstanding contributions to the advancement of commercial diving in the areas of increased safety or performance.

The Stover-Link Award, for recent significant contributions to undersea biomedical research.

The Craig Hoffman Award for outstanding contributions to diving safety.

Please send nominations to:

Eric P. Kindwall, M.D.
Director, Department of Hyperbaric Medicine
St. Luke's Hospital
2900 West Oklahoma Avenue
Milwaukee, Wisconsin 53215

## NOMINATIONS FOR UMS OFFICERS

If you have a candidate you want to see on the ballot for President-Elect, Vice President, Treasurer, Secretary, or Member-at-Large, please follow the procedure indicated in Article I of the Bylaws, as stated on pages ix-x of the UMS 1978 Handbook and Membership Directory. Petitions must be in the Secretary's hands prior to 31 December 1978. The Secretary of the Society is: Merrill P. Spencer, M.D.

The Chairman of the Nominations Committee, Jefferson C. Davis, M.D., would also welcome suggestions regarding any of these offices. Addresses for Drs. Spencer and Davis may be found in the Directory.

## METRIC DIVE PLANNING CALCULATOR

This calculator has been constructed in accordance with the Royal Naval Physiological Laboratory tables. By setting the arrow at the depth at which you are or to which you intend to dive, you can read at a glance the conversion from metric to feet, your no stop time, your first decompression stop, your average air requirement, your ascent time from this depth and the absolute pressure at this depth in bars and fifths of a bar.

Available from NAUI Headquarters, P.O. Box 630, Colton, California 92324. Price $6.00 (membership discount applies).

## PHYSICAL QUALIFICATIONS FOR COMMERCIAL DIVING

Recently a number of diving school graduates have been turned down for jobs because of medical conditions not previously discovered. The two main a areas of difficulty are the eyes and the back. Apparently the diving contractors are applying more stringent requirements than those approved by the Association of Diving Contractors, of which they are members.

While the precise eye requirements are not yet clear, the back problem seems to be primarily what is termed "class III back", which is a congenital condition known as spondylolisthesis, in which there is some slippage of the spinal column off the sacrum. Applicants with this condition, no matter how mild its degree, are automatically rejected.

The situation apparently arises from a fear of liability on the part of the contractors. The position taken by the insurance companies is that if it can be proved that a physical condition might have caused an accident resulting in injury, the responsibility is that of the contractor, who should have detected the condition in the first place.

At present the Commercial Diving Center is conferring with the Association of Diving Contractors to establish guidelines satisfactory to all parties. The Association of Commercial Diver Education is attempting to clear up the confusion and standardize physical requirements. Four physicians experienced in hyperbaric medicine are conducting a study at CDC to establish precisely which physical conditions should be contraindicative. The purpose of all this activity is to come up with a standard medical examination form that can be used by everyone.

Meanwhile, prospective trainees are urged not to try to economize on their initial physical examination before they begin training as divers. Attempts are being made to bring down the cost of good physical examinations as required in this field. To find out whether or not one has a "class III back", it is necessary to have a lumbo-sacral, lateral, and anterior-posterior x-ray, read by a competent radiologist. Attempts are also being made to bring down the cost of such x-rays. (MFW from a memorandum by Jim Joiner, of CDC)

## DIVE RESCUE SPECIALIST TRAINING PROGRAM

The Dive Rescue Specialist Training Program trains qualified personnel to react responsively and to perform the many tasks involved in dealing with surface and subsurface accidents. The program was developed by two former investigators with combined experience of over 23 years in law enforcement and dive rescue work. These courses are sponsored



by Scuba Schools International. Tuition for the five-day course is $250. They are held in widely scattered areas across the country and each course is adapted to the special local problems and conditions.

Courses remaining to be given this year will be held as follows: September 18-22 in Lincoln Park, New Jersy; September 25-29 in Lake Ozark, Missouri; October 16-20 in Fort Collins, Colorado; November 6-10 in Medford, Oregon; November 13-17 in San Antonio, Texas.

For application forms please write to Dive Rescue, 1449 Riverside Drive, Ft. Collins, Colorado 80521.

## SUBSEA WORK MODULE

From the French Center for Underwater Studies and Research Techniques comes a new subsea work module for the storage of tools and equipment. The diver has access to anything he might need to accomplish an underwater task without returning to the bell or the lock-out submersible.

The module, which has a depth capability of 600 meters consists of two parts. The base rests on the seabed and houses heavy equipment such as transformers, generators, pumps, etc. The upper part, which is positively buoyant, carries tools for the diver as well as a frame on which a lock-out submersible may rest. A surface control console permits monitoring.

Hydraulic, electrical, pyrotechnical, and pneumatic tools, as well as oxygen cutting torches, can all be operated from the module. (MFW from Ocean Industry, June 1978)

## DIVE MED INTERNATIONAL

UMS members Watson Kime, M.D., and Edward Sherrer, M.D. of Dive Med International, have been since last November acting as medical consultants to Baltimore's rapid transit system. They will supply medical support to the compressed air workers and to anyone else who would have occasion to be exposed to compressed air. The contract is for the duration of the project.

Drs. Kime and Sherrer have also been named medical consultants on the Johns Hopkins University Diving Control Board.

## SCUBA ACCIDENTS

John McAniff, of the University of Rhode Island, has completed his most recent scuba accident report, which covers the year 1976. Although scuba fatal ities usually increase each year by 5 or 6 percent, the number of divers increases by about 15 percent Thus, scuba diving appears to be becoming slightly safer.

In summarizing his findings, McAniff attributed much to human error and to poorly designed equipment. There is a need for more human factors engineering in the design of equipment, much of which has become dangerously complex. Divers are often overburdened with too many hoses and other stranglers, and some pieces of equipment are incompatible with others. (MFW from "Washington Currents", by P.Z. Trupp, in Sport Diver, Second quarter, 1978)





## THE ASSOCIATES' CORNER

### NAVY DIVING SYSTEM CERTIFICATION

L. Hurley
Naval Medical Research Institute
Bethesda, Maryland 20014

While Navy Diving System Certification process and procedures are guided by two basic Navy scriptures (NAVMAT P-9290[1], & MIL STD 882A[2]), which are not binding for industry or other government agencies, it is a valuable evaluation tool by which may be provided reasonable assurance that a catastrophic accident involving material or personnel will not occur. The main objective of the certification process is to verify that the life critical systems provide acceptable levels of personnel safety throughout the specified operating range when used with qualified personnel and in accordance with approved operating, maintenance and emergency procedures.

The certification process should be ongoing and be concerned with establishing maximum reasonable assurance of the recovery of personnel without injury and the deliberate avoidance of conditions that imperil the lives and well-being of operating personnel.

Most accidents result from a series of events beginning with a single failure, often relatively minor, which may place personnel or equipment under additional stress. The prevention or avoidance of these initial failures enhances the overall safety of the system.

The philosophy of certification is, therefore, to consider only single failures and their effect on the system. Based upon this philosophy, systems and equipments can be classified as life-critical certified or non-certifiable. Life-critical components are those elements where failure almost certainly will result in a casualty and stringent regulations are necessary to minimize, to the greatest degree, the possibility of failure.

System certification is a methodical, independent review of the documentation verifying that system elements have been designed and constructed of proper materials, assembled, cleaned and performance-tested in accordance with acceptable engineering practices, and that the operating and maintenance manuals provide sufficient information to allow the system to be operated safely. This independent review and effective control of design, fabrication, testing, construction, inspection, maintenance and operation is imperative because of the complexity of systems involved and the immediate impact on safety.

Certification is the final Navy check to insure that no recognizable unsafe conditions exist in the system prior to its manned operations. System certification cannot positively assure that an accident cannot or will not happen; it is, however, intended to provide maximum reasonable assurance to all participants that the system will perform safely.

1 Naval Material P-9290, System Certification Procedures & Criteria Manual
2 Military Standard 882A, System Safety Program Requirements

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## LUXEMBOURG MEETING, OCTOBER 1978

"Medical Aspects of Diving Accidents"

LAST CALL FOR REGISTRATION AND FOR SUBMITTING SHORT COMMUNICATIONS

A Congress on the medical aspects of diving accidents is due to be held on 12th/13th October 1978 in Luxembourg, under the sponsorship of the Mines Safety and Health Commission, Commission of European Communities. The scientific programme is being organised by the European Undersea Biomedical Society in association with the Medical Sub-committee of the European Diving Technology Committee.

UNCONSCIOUSNESS OF THE DIVER IN THE WATER

Review Papers: "The physiological basis for loss of consciousness underwater"
Dr. M. Childs, University of Aberdeen.
"Rescue and resuscitation of the unconscious diver"
Mr. G. Arnoux, Comex Diving.

DIAGNOSIS OF DECOMPRESSION SICKNESS

Review Papers: "Ultrasound in decompression"
Mr. G. Masurel, French Navy.
"Diagnostic techniques in decompression illness"
Surgeon Commander R. Pearson, Royal Navy.

TREATMENT OF DECOMPRESSION SICKNESS

Review Papers: "The use of pressure and oxygen as independent variables in the treatment of decompression casualties"
Surgeon Captain E.E.P. Barnard, Royal Navy.
"Drugs in the treatment of decompression casualties"
Medecin-en-chef B. Broussolle, French Navy.

COINCIDENTAL INJURY OR ILLNESS WHILE AT RAISED ENVIRONMENTAL PRESSURE

Review Papers: "Anaesthesia at depth"
Dr. Y. Kermorgant, French Navy.
"The case for a mobile intensive care team"
Professor J.N. Norman, University of Aberdeen.

Submitted papers (of 10 mins. duration plus 5 mins. questions) upon related physiological and medical aspects are invited and will be presented following the review papers.

There will be simultaneous interpretation into several European languages but facilities limit the numbers attending to 150 persons. Pre-registration by mail is therefore essential. Enquiries and abstracts should be directed without delay to the Congress Secretary:

Surgeon Lieutenant Commander T.G. Shields, RN
Institute of Naval Medicine
Alverstoke
Gosport
Hampshire, England

## BRITISH COLUMBIA DIVING INSTRUCTOR'S COLLEGE

There will be evening and weekend courses held locally, and 200-hour courses with ocean work on the Oregon and California coasts, or locally if desired. All instructor courses will include equipment maintenance, public speaking, and cardiopulmonary resuscitation. Brochures are available from the College at 2659 Kingsway, Vancouver, B.C. V5R 5H4, Canada.

## PUBLICATIONS OF INTEREST

Gamble, J.C. and R.A. Yorke, eds. Progress in Underwater Science. Volume 3 (new Series) of the Report of the Underwater Association, 1978. Pentech Press, Ltd., Estover Road, Plymouth, Devonshire, U. K. Price £ 12.50 (in UK only) or $27.50 U.S. This volume consists of selected papers presented at the eleventh symposium of the Underwater Association (originally called the Underwater Association of Malta) held at the British Museum in March, 1977, plus a few additional invited review articles. Subject areas are archeology, geology, biology, physiology and psychology, and technology and submersibles.

Gallar Montes, Fernando. Curso de Primeros Auxilios para Marinos [First Aid Course for Seamen]. 1975 Egraf, S.A., Poligono Industrial de Vallecas, Madrid 31, Spain. In Spanish. A complete first aid manual, well illustrated with drawings and photographs. Includes rescue techniques.

Gallar Montes, Fernando. Higiene Naval [Naval Hygiene]. 1977. Egraf, S.A., Poligono Industrial de Vallecas, Madrid 31, Spain. Environmental hygiene, Parasitology and epidemiology, Ship hygiene, Nutritional hygiene, Sanitary standards for personnel, Survival at sea, Personal hygiene, Personal hygiene on long voyages and in diverse climates, Tending the ill with no doctor aboard, Sanitary problems as affected by international regulations, Sanitary problems in port, Hyperbarism (diving physiology and pathology).

National Fire Protection Association. NFPA No. 56D. Hyperbaric Facilities 1976. This is an update on the NFPA standards, and is recommended for all those involved with hyperbaric chambers. Available from National Fire Protection Association, 470 Atlantic Ave., Boston, Massachusetts 02210. Price $2.50.
Rutkowski, D. Diving Accident Manual. Florida Underwater Council, in cooperation with the National Oceanic and Atmospheric Administration. This manual is directed to the layman with little understanding of diving medicine. It tells how to stabilize the victim and get him safely to a proper treatment facility. Price $1.00. Available from The Florida Underwater Council, 75 Virginia Beach Drive, Miami, Florida 33149. Proceeds go to the Council for Diving Safety Programs in southern Florida.

## EMERGENCY ASCENT TRAINING

The heads of major scuba certifying agencies met in Washington recently to discuss the question of emergency ascent training. Since 1970 there have been 28 fatalities during emergency ascent training out of 1.5 million scuba divers trained. Although statistically this is very small, the figure is still not acceptable.

While there are still unanswered questions such as the long term effects of pulmonary disorders and cigarette smoking, several conclusions were arrived at during the conference.

Although it is not necessary for a conscious diver to look toward the surface during ascent, it is essential that an unconscious diver's head be hyperextended by his rescuer on the way up.

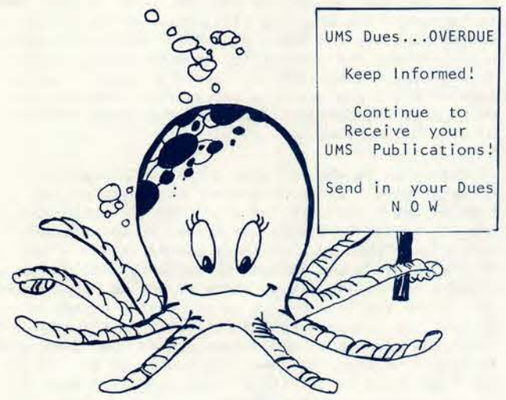
It is best to keep lung volune at mid-range. The diver should keep his regulator in place. He may then be able to gain a little air when near the surface.

The octopus is not fail-safe. It does not always work properly with two divers breathing from it.



This is possibly because the tank orifice is too small to give enough air for two at depth. It is important that the second stage regulator be of the same brand as the first.

The certifying agencies are seeking a 100 per cent safety record. The availability of insurance is one of their important problems. More meetings are planned, and eventually a full report will be issued with emphasis on a fail-safe approach. (MFW from "Washington Currents", by P.Z. Trupp, in Sports Diver, Second quarter, 1978).




## DIVING SAFETY MEMORANDUM NO. 15 1978

High Pressure Half Inch Re-usable Brass Hose End Fittings

Reports from the Diving Industry indicate that some high pressure half inch re-usable brass hose end fittings can be damaged by over-torque. Over-torque can fracture the swivel female nut. It is possible for this fracture to go undetected which could create a dangerous situation if the fitting blew under high pressure.

Diving companies are recommended to inspect all such fittings and satisfy themselves that they are safe and that the particular fitting in use is of sound construction and suitable material, is in good working order at all times and is adequate for the purpose for which it is to be used.

COMMANDER S A WARNER
Chief Inspector of Diving

## DEEP SEA DIVING SCHOOL QUALIFIES FOR WINSTON CHURCHILL MEMORIAL TRUST AWARDS

The Commercial Diving Center has been notified that the school qualifies for Churchill Fellowships for Australian residents desiring to pursue deep sea diver training. Said Mr. R.A.L. Morant, Chief Executive Officer of the Trust, "One of the objectives of a Churchill Fellowship is to enable Australians to meet a wide cross-section of people in other countries and to acquire new knowledge from overseas." The first CDC graduate from Australia under the Fellowship was Timothy Brookings who returned to his homeland and is working in the offshore oilfield diving industry.



An ambulance was summoned and the patient was taken to St. Luke's Hospital, his feet still placed higher than his head and his body tilted slightly to the left. The patient was conscious but confused upon arrival at St. Luke's Hospital.

He was taken into the chamber and compressed to 165 feet on 80/20 helium-oxygen. After 4 minutes at 165 feet, the patient was symptom free and his chest pain was gone. He was then decompressed over a 15 minute period to 60 feet where he was placed on oxygen and the remainder of U.S. Navy Table 6A was run. The patient emerged from the chamber with no residual symptoms and was discharged home with no sequelae.

The patient had been a scuba diver for approximately one year. This was the beginning of his second season and his first dive of the year. He had had no previous attacks of decompression sickness.

There were two contributing factors.

First, the patient was weighted light and therefore had a tendency to rise spontaneously when he was motionless in the water. When he had difficulty clearing his ears he stopped swimming and started doing the Valsalva maneuver. During this time he undoubtedly was ascending and because of ascent with a closed glottis, ruptured his lung.
Second, the man was diving without a nearby buddy; this could have cost him his life.

The patient showed no evidence of paralysis or other neurologic signs other than confusion. The only definite neurological symptom that could be identified was unconsciousness and symptoms referable to cerebration. The possibility that he had a convulsion initially cannot be ruled out. We believe, however, that the correct diagnosis is arterial air embolism secondary to lung rupture while inadvertently ascending under water.

Eric P. Kindwall, M.D.
Director, Department of Hyperbaric Medicine
St. Luke's Hospital

## EAGLE

USS TANAGER, a minesweeper commissioned in 1945, was purchased by Sea Films, Inc. and converted to the research vessel, EAGLE. During its conversion, 82 tons of military equipment and machinery have been removed and replaced by photographic equipment, scientific laboratories both wet and dry, and an aquarium.

Dr. Sylvia A. Earle, Research Biologist at the California Academy of Sciences, has been appointed Chief Scientist, to develop and direct a scientific program.

Construction planned for this year includes a double-lock four man recompression chamber, two dive support boats, an air/mixed gas bell diving system, and hoisting equipment.

EAGLE's compressed air system will be the most sophisticated in the world. Included in the complete air system, designed and constructed by Ingersoll Rand, are two fully automated 23 ft /min, 5000 psi diving air machines as well as systems to supply laboratory air, recompression chamber, and ship operations.

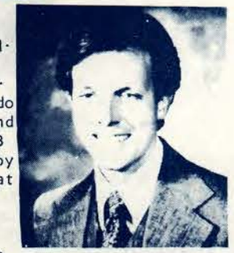
Although it is still in the construction phase EAGLE is already serving as a base for Sea Film's



underwater photographic and research activities. Early in 1977, EAGLE served as a base from which was organized a film on hump-back whales (later broadcast on NBC/TV). Field work, in which Al Giddings and Sylvia Earle collaborated with Dr. Roger Payne and Katy Payne, was done in Hawaii. Supporting the project were the National Geographic Society, the World Wildlife Fund, the New York Zoological Society, and the California Academy of Sciences.

Peter Guber, producer of The Deep, has indicated a great interest in the future network plans for EAGLE, which he has been discussing with Al Giddings. Since producing The Deep, Guber has become increasingly committed to the problems and current conservation issues concerning the sea. (MFW from a news release of Sea Films, Inc.)

## *UMS MEMBER NAMED FASEB CONGRESSIONAL SCIENCE FELLOW*



*Dr. Schatte*

Dr. Christopher L. Schatte, a member of The American Physiological Society and assistant professor, Department of Physiology and Biophysics, Colorado State University, was named and introduced as the fourth FASEB Congressional Science Fellow by FASEB President E. Leong Way at the Annual Meeting Public Affairs Symposium in Atlantic City. Dr. Schatte will begin his one-year tour of duty with the Congress September 1, 1978. He earned his doctorate in physiology at Colorado State in 1972 and did post-doctoral work at the Royal Naval Physiological Laboratory, Alverstoke, England, and at Colorado State. His research interests are in environmental and pressure physiology.

## Institute of Offshore Engineering Information Service

The Institute of Offshore Engineering was established in 1972, with financial aid from the Wolfson foundation. Engineers and an information officer were appointed, and quarters built on the campus of Heriot-Watt University at Riccarton near Edinburgh. The main purpose of the IOE Information Service is to serve those connected with the offshore oil industry who need a consulting service in marine technology. This has been an active field at Heriot-Watt University for some years, and the IOE makes full use of this expertise. Areas that they are concentrating on at present are offshore instrumentation, marine biology, environmental monitoring, safety and risk assessment, and methods of diver replacement.

The library of the Institute aims at assembling the most important material available on offshore engineering. Most of this, fortunately, is in English. Journals, symposia proceedings, standard specifications, codes of practice, patents, reports, government publications, trade brochures, text books, and directories make up the collection. There is also an archive of technical films.

Any individual or group may make use of the service. Inquiries are answered free of charge if they do not consume a great deal of staff time . Charges are made in accordance with the amount of staff time used, and also if computer services are consulted. An alerting service is also offered. (MFW from an article by Arnold Myers in the Journal of the Society for Underwater Technology, March 1978)

*Courtesy, Embassy of Greece*

## SEVENTH UNDERWATER PHYSIOLOGY SYMPOSIUM

The Governing Board of the Seventh Underwater Physiology Symposium has announced that the next symposium will be held July 6 - 10, 1980, in Athens, Greece. The Undersea Medical Society will hold its annual scientific meeting on the first day; this will consist of the presentation of short papers and poster sessions. The symposium itself will continue for three days of invited and selected papers. On the fifth day, the European Undersea Biomedical Society will hold a scientific meeting devoted to the presentation of papers dealing with both clinical and applied problems in diving. It is expected that these papers will be incorporated into the proceedings of the International Congress of Physiological Sciences, which will be held in Budapest, Hungary, July 13 - 19. The Governing Board hopes that the Seventh Symposium will be recognized as a satellite symposium of the Congress.

Current members of the Governing Board are Drs. Kenneth Ackles, Alfred Bove, Bernard Broussolle, David Elliott, Carl Magnus Hesser, Herbert Saltzman, and, representing the Symposium's sponsors, Dr. Arthur Bachrach for the Undersea Medical Society, Dr. James Clark for the Institute of Environmental Medicine, University of Pennsylvania, Dr. Suzanne Kronheim for the Office of Naval Research, U.S. Navy Department, and Dr. James W. Miller of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce. Dr. Bachrach is Chairman of the Governing Board.

Further details regarding the scientific program of the Symposium and special arrangements such as travel packages will appear in future issues of Pressure.

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## *SHOULD WE DOPPLE IN THE SEA?*

Much attention was focussed upon ultrasonic bubble detectors during the recent UMS meeting in Seattle and the preceding workshop on this subject so well organized by Dr. Merrill Spencer. Of the many techniques which have been used for bubble detection over the years, only those employing the Doppler principle are sufficiently cheap, robust, stable, simple to operate and sufficiently well developed commercially to be considered for widespread use by the diving industry as an early warning of decompression sickness. Other techniques may be better but they are either too expensive, too difficult to interpret or so sensitive to the many variables which cannot be controlled outside of the research laboratory (my own conductivity approach included) that they are impracticable offshore. Personally, I gave up Doppler monitoring in the conventional precordial position some six years ago when, in a series of simple air exposures of goats followed by no-stop decompression, we found cases with bends/bubbles and no bends/no bubbles (as predicted) but almost as many with bubbles/no bends and even one with no bubbles/bends. While much evidence was presented in Seattle, particularly from workers in France and Japan, to indicate that the correlation between bends and precordial Doppler signals can be quite impressive, is it good enough to burden the professional diver with yet another device to carry? Furthermore, why is the device not correct in its predictions 100% of the time?

To take the last question first, Doppler technology seems to be so advanced that there is little doubt that the device will detect almost all bubbles in its field, so we are then obliged to ask what the device actually "sees" when used in the popular precordial position. The answer is, of course, that it is monitoring the bubbles in the pulmonary artery and, therefore, almost all bubbles formed in venous blood or deposited into the venous system from any or all tissues in the body. The bubbles actually detected are asymptomatic since they are normally filtered out by the lung. At least, this is probably true unless one of several factors facilitates their escape to the arterial system or they are present in such numbers in the lung and penetrate the microvasculature to the level at which they can press upon "J" receptors or irritant receptors to elicit a bronchospasm. Hence it is most interesting that, when the data were broken down into symptom categories, by far the most impressive correlation presented at Seattle was that between Doppler bubbles and "chokes."

This line of argument may indicate that we should really be monitoring the arterial system for bubbles escaping the filtering action of the lung especially since, as we find in our own laboratory, even single 30μ bubbles can be readily detected in quite distal arteries by non-invasive methods employing the new 8 MHz probes - the same probes described by Dr. Philip James in connection with pneumothorax location (Pressure: December, 1977). However, while a reliable arterial monitor may provide a most meaningful research 'tool', the fact that bubbles have already reached the arterial system implies that neurologic symptoms are imminent and the warning may come too late to take effective preventive action.

There are now several studies to show that bubbles may escape into the arterial system if the lung is overloaded with venous bubbles, but many factors seem to influence the trapping efficiency so that total venous bubbles, and hence precordial Doppler signals, only indicate the probability of arterial gas emboli. In any case, limb bends are likely to occur long before arterial gas embolism arises from overload, so we need an earlier alert than the confirmed presence of arterial bubbles.

This then raises two questions: which bubbles actually give rise to limb bends and where do the bubbles arise which we can detect by the precordial Doppler monitor? Taking the first, it is probably fair to say that much evidence can be cited to show that limb bends are induced by extravascular gas in a tight connective tissue where it builds up pressure on a nerve ending since it cannot easily expand as it would in a more compliant tissue. On the other hand, the bubbles in the venous system have been seen issuing from fatty tissues, presumably on account of the high lipid solubility of most gases, so that it is an academic question whether they are formed directly in blood or are deposited into the vascular system from extravascular sites. It can be argued that a simple decompression which forms more gas in a fatty tissue, and hence more venous bubbles, is likely to deposit more gas in the critical connective tissue. Thus it is easy to see how Doppler signals show a positive correlation with limb bends and how Spencer was able to show such a good prediction of Type I symptoms for no-stop decompressions. However the more complex the decompression profile, the less likely that the state of a fatty tissue will reflect that of the aqueous connective tissue. Hence the most important piece of information to my way of thinking was a comment at the Seattle meeting by Mr. Ed Murphy to the effect that the correlation between precordial Doppler sounds and decompression sickness is not as good after the diver has followed a long complex decompression profile. This would indicate that precordial Doppler monitoring is only good for predicting bends for as long as the bubble emission from a fatty tissue continues to reflect the state of an aqueous connective tissue and is therefore more reliable for simple dives.

Brian A. Hills
University of Texas Medical Branch
Galveston, Texas 77550

## DIVERS STILL IN DEMAND

News release #85 by the Commercial Diving Center reports that for the first quarter of 1978 CDC was "faced with the happy problem of having more jobs than graduates!" This is a continuation of the situation which prevailed in 1977. A new development is the tripling of the number of jobs available in lake, rivers, and canal operations within the United States, which means that the graduate diver is no longer faced with the likelihood of having to accept a job in foreign waters. If for personal reasons he prefers to remain in the U.S. there is ample opportunity for employment.



## FORTHCOMING MEETINGS

THIRD CANADIAN DIVING SYMPOSIUM, Defence and Civil Institute of Environmental Medicine, 1133 Sheppard Ave., P.O. Box 2000, Downsview, Ontario M3M 3B9, Canada, October 30-31, 1978. The four general subject areas will be: Commercial diving operations, Industrial diving research and development, Government departments diving research and development, and other topics of interest. Abstracts or papers should be submitted by August 31 to Mr. Fred Cox, Diving Division, at the address given above.

EUROPEAN OFFSHORE PETROLEUM CONFERENCE AND EXHIBITION (Europec) This event is modeled on the Offshore Technology Conference held annually in Houston, Texas. It will be held at Earl Court, London, October 24-27, 1978. It is being organized by the UK Society of Petroleum Engineers, and cosponsored by the Institute of Petroleum and the Institution of Civil, Mechanical, and Electrical Engineers. Eleven countries have applied for national stands, and over 200 companies have received 13,000m of exhibition space.

NAUI UNDERWATER FILM REVIEW. John Hancock Hall, Berkeley St., Boston, Massachusetts, September 16, 1978, 8 P.M. Contact: Fred Calhoun, PO Box 291, Back Bay Annex, Boston, Massachusetts 02117.

VISION 360: International Diving Symposium, State University College, Buffalo, N.Y. Contact: Dallas Edmiston, Vision 360, 185 Forest Hill Drive, Williamsville, New York 14221.

OCEANS 78. Sheraton-Park Hotel, Washington, D.C., September 6-8, 1978. Fourth annual conference, sponsored by the Marine Technology Society and the Institute of Electrical and Electronics Engineers' Council on Ocean Engineering. Approximately 150 technical papers will be presented and published in the Conference Record. In addition, there will be exhibits and film programs. Contact Anthony Ellers, Program Chairman, Oceans 78, Suite 412, 1730 M St., N.W., Washington, D.C. 20036.

IQ10. Tenth International Conference on Underwater Education. November 9-12, 1978. Disneyland Hotel, Anaheim, California. There will be poster sessions, workshops, pool demonstrations, and scheduled debates. Papers presented at the technical sessions will be published in the Proceedings. Contact NAUI Headquarters, P.O. Box 630, Colton, California 92324.

SONOMA COUNTY DIVER RESCUE WORKSHOP, Santa Rosa Junior College, October 7-8, 1978. Contact Rich Swain, Director, P.O. Box 3967, Santa Rosa, California 95402.

BUSINESS OF DIVING: EQUIPMENT SEMINAR. Falls Church, Virginia, November 4-5, 1978. Contact Jay Wenzel, Director, 7707 Mayknoll Ave., Bethesda, Maryland 20034.

International Conference on Meteorology and Oceanography Applied to the Engineering, Installation and Operation of Offshore Structures. October 31 - November 1, 1978, at The Royal Institution of Engineers, the Hague, Netherlands. Organized by The Society for Underwater Technology, The Royla Meteorological Society, The Royal Institution of Engineers in the Netherlands and The Netherlands Council for Oceanology. For information on registration, contact The Society for Underwater Technology, 1 Birdcage Walk, London SWlH 9JJ.

WOMEN & DIVING CONFERENCE. Wellesley College Science Center, Wellesley, Massachusetts, October 21, 1978. Sponsored by Aquawomen NAUI. Contact: Valerie Costelloe, East Coast Divers, 213 Boylston St., Brookline, Massachusetts 02146.

**COURSES IN DIVING MEDICINE SPONSORED BY UMS**

CORRECTION

Submarine and Diving Medical Officer's Course

9 October - 10 November 1978

Approved for 60 Category I CME credits.

Site: Defense & Civil Institute of
Environmental Medicine (DCIEM)
1133 Sheppard Ave. W.
Downsview, Ontario M3M 3B9
Canada

Contact: M. Lepawsky, M.D.
6090 Fraser Street
Vancouver, BC V5W 2Z7
Canada

SHORT WEEKEND "SPECIAL TOPICS" SEMINAR

Sport Diving Medicine

28 September - 1 October 1978

Staff: Jefferson C. Davis, M.D.
8710 Data Point, #7604
San Antonio, Texas 78229

Peter Erickson, M.D.
Diving Emergency Medical Offshore Services
4400 General Meyer Ave.
New Orleans, Louisiana 70114

This short course on the medical aspects of sport scuba diving will be an in-depth study of selected topics of interest to diving physicians. The academic program has been arranged to maximize actual diving experience at Grand Cayman. While the Undersea Medical Society sponsors only the academic program, the course is limited to certified divers in order to offer extensive underwater time to stress practical experience on the marine life-medical aspects emphasis of the course.

Approved for 8 Category I CME Credits.

11 - 18 November 1978 and
21 - 28 April 1979

Basic Diving Medicine Course

Site: Freeport, Bahamas

Contact: Edward Tucker, M.D.
64 A North Main Street
Essex, Connecticut 06426

25 November - 3 December 1978

Tenth International Physicians Underwater Medicine Program

Site: Bonaire and Curacao, Netherlands Antilles

Staff: John M. Alexander, M.D., Richard L. Bell, Ph.D., and Vincent O'Hara, M.D. The academic program consists of 25 classroom hours; illustrated lecture sessions covering history of diving medicine, review of diving physiology, physical standards for divers, decompression sickness, near-drowning, poisonous and venomous marine life, sham treatments, case discussions, special topics seminars. Contact PUMP, P.O. Box 530344, Miami, Florida 33153. Phone 305-754-7480.
Approved for 25 Category I CEM Credits.

2 - 9 December 1978

Physicians Program in Undersea Medicine

Site: San Salvador Island, Bahamas

In addition to all aspects of diving medicine, there is included an introduction to hyperbaric oxygen therapy as it is currently used in the treatment of disorders not related to diving. Diving program is also planned. Contact: Bruce E. Bassett, Ph.D., Human Underwater Biology, Inc., P.O. Box 5893, San Antonio, Texas 78201. Phone: 513-492-9395.

Approved for 30 Category I CME Credits.

2 - 10 December 1978

Advanced Course in the Medicine and Physiology of Sport and Scuba Diving

Site: Bonaire and Curacao, Netherlands Antilles

Staff: Jefferson C. Davis, M.D., Peter B. Bennett, Ph.D., David Elliott, M.D., Ph.D., and Eric Kindwall, M.D. Drs. Bennett and Elliott are the authors of The Physiology and Medicine of Diving, the standard text in the field. Full diving program planned in addition to academic program. Contact: Jefferson C. Davis, M.D., 8710 Data Point, #7604, San Antonio, Texas 78229.

Approved for 25 Category I CME Credits
Approved by the American College of Emergency Physicians for 25 ACEP Category I Credits

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*HITS and NEAR MISSES*

## DIVING ACCIDENT REPORT FROM ST. LUKE'S HOSPITAL MILWAUKEE, WISCONSIN

The patient, an 18-year old male, was scuba diving with a number of companions in a quarry about 55 feet deep near Racine, Wisconsin. His friends descended easily to the bottom but the patient had difficulty clearing his ears. His initial attempt at a dive brought him to thirty feet when he had to return to the surface because he was unable to clear his ears. Instead of returning to the shore, he decided to descend once again to try to find his companions. He got down to a depth of about 35 feet and then, while hanging upright in the water, attempted to do the Valsalva maneuver. He was not holding on to any descending line. The next thing he remembers is that he saw blood in his face mask and he surfaced.

After this the history is not clear but his companions say that two bystanders saw him floating face down in shallow water and dragged him ashore. A local deputy sheriff who had had training in scuba diving immediately suspected air embolism and placed him feet uppermost and on his left side. By this time, blood was appearing both at his nose and mouth. The patient was unconscious for a period but regained consciousness within several minutes. He seemed somewhat confused and complained of chest pain.



# LETTERS TO THE EDITOR

Mouth-to-Snorkel Ventilation

Editor, Pressure

Dear Sir,

Divers who become apneic from near-drowning or any other reason must be ventilated while towed through the water to boat or beach. Diving instructor courses now emphasize practice in mouth-to-mouth ventilation under simulated water rescue conditions. In the many drills I have witnessed, the big problem has been water getting into the victim's mouth. Blowing this down into a real victim's lungs would probably erase whatever chance of survival he had. To overcome this danger, Al Pierce, a recognized water safety authority, has been championing a method of mouth-to-snorkel ventilation. Though initially more difficult to learn, once mastered it is easier to perform and in some situations much safer.

NAUI now has on file a formal report of a witnessed rescue in which a female diver saved the life of an apneic male diver by mouth-to-snorkel ventilation, after finding that prevailing conditions made mouth-to-mouth impossible. I believe that the method deserves a wider trial than it has had. Details may be obtained from Al Pierce, 663 Parkview Blvd, Yeadon, PA 19050.

Charles V. Brown, M.D.

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Norwegian Diving Requirements

Editor, Pressure
Dear Sir,

In Pressure Vol. 7, No. 2, page 11 there is an article on Norwegian emergency evacuation requirements In this connection I want to inform you that the control and inspection of diver working conditions in the Norwegian sector of the North Sea is now the responsibility of the Norwegian Petroleum Directorate. Temporary regulations for offshore diving were issued and put into force by 1st of July this year. Regulations related to working hours for offshore divers are expected this fall.

Jens Smith-Sivertsen

**Subsidiary of HYCO Sets Records**

Hyco Subsea, Inc., the year-old operations branch of International Hydrodynamics (Hyco) was hired last December by the Seagap consortium to operate its PISCES VI submersible from the drillship DISCOVERER SEVEN SEAS off the Congo. During the operation, PISCES set a new depth record for a petroleum-related dive - 4346 feet. Seagap was spudding its Sangha 1-Na. PISCES made 14 dives before the initial test was completed, performing such tasks as checking alignment and positioning, waterjetting sediment from the guide base for reception of the blowout prevention stack, and inspection of the riser from the bottom to the surface. This constituted a record for the largest number of consecutive dives (14) in one location.

Hyco Subsea had previously established a world's record for the deepest commercial dive by a submersible when they buried cable in 5200 feet of water off Block Island. The company has, with its 1,100-foot depth AQUARIUS, exceeded by a factor of three all other U.S. submersibles combined in the number of petroleum-related dives made. The parent company, Hyco, was started in 1963 by two divers, Al Trice and Don Sorte, with $10,000 each, in a Vancouver garage. Their original idea was to purchase submersibles and start a service. When they couldn't find one that was suitable, they took in another partner, inventor Mac Thomson, who designed PISCES I. Several engineering firms refused to tackle the design, declaring it impracticable, but finally Vancouver Iron and Engineering Works built it. Going was slow at first, with a few minor salvage jobs and then a five-month contract with the Navy to recover some torpedoes. Finally, the offshore oil boom gave Hyco the boost it was waiting for. With financial backing by Vickers Oceanics, more PISCES subs were built. To-day Hyco is out in front in producing work submersibles. Its only real competitor is Perry Oceanographics, who builds smaller, less expensive submersibles with less depth capability. (MFW from an article by Ann Cozens in Offshore, June 5, 1978).



## NEWS OF MEMBERS

Médecin en Chef René Hyacinthe, of the Centre d'Etudes et de Recherches Bio-Physiologiques Appliquées à la Marine, Toulon, France, was recently advanced (effective 1 Nov 77) to the level of Professeur Agrégé, (consultant) in Physiology and Ergonomy at the French Navy School of Health Service Application. Professor Hyacinthe is a graduate of the School of Aerospace Medicine in Pensacola, Florida, where he underwent flight surgeon training. A major portion of his research career has been spent at CERB.

**NAUI Bibliography**

The NAUI specialty course bibliography has been brought up to date as of December 1977 by Barbara Frost, an Our World Underwater scholarship finalist. It had been originally undertaken by two former OWU finalists in 1976. The bibliography is printed in the March/April 1978 issue of NAUI News.

The categories covered are: cave diving, deep diving, ice diving, diving leadership, professional diving, search and recovery, underwater hunting and collecting, underwater photography, and wreck diving.

All the publications on the list are directed primarily to the sport diver, and the diving instructor. All publications are available from NAUI headquarters Box 630, Colton, CA 92324.

## L.A. HARBOR DEEP SEA DIVING SCHOOL DIRECTOR SELECTED FOR CAL/OSHA ADVISORY COMMITTEE

Jim Joiner, Executive Director of the Commercial Diving Center in Wilmington, has been selected as a member of the California/Occupational Safety and Health Administration Advisory Committee. The Advisory Committee will participate in the review of the commercial diving standards for the State of California.

California's approach to developing commercial diving standards is in direct contrast to the Federal government's technique. In California, the Division of Industrial Safety will draft a set of standards regulating commercial deep sea diving, and then submit the draft to the Advisory Committee for review.

**PRESSURE**

*A bi-monthly Newsletter* PUBLISHED BY THE
UNDERSEA MEDICAL SOCIETY, INC.
9650 ROCKVILLE PIKE, BETHESDA, MARYLAND 20014

C. W. SHILLING, M.D. — EDITOR
MARGARET F. WERTS — ASSOCIATE EDITOR

SALLY T. MCALLISTER — LAYOUT
YVETTE P. DESAUTELS — COMPOSITION

Rates: $7.50 Annually
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## NORWEGIAN UNDERWATER INSTITUTE

The Norwegian Underwater Institute, located in Bergen, is jointly owned by Det Norske Veritas and the Royal Norwegian Council for Scientific and Industrial Research. It is strategically located on the coast where it can take advantage of the deep fjords for testing purposes and of proximity to the North Sea underwater activities.

The core of the Institute is the hyperbaric chamber complex which consists of two living chambers which can accommodate a total of eight divers, one transfer chamber and one large chamber for diving or technical testing. The facility has a saturation depth capability of 500 meters, with excursions to 650 meters. Plans for the future include equipping the large chamber as an operating room in which surgery can be performed on injured divers who have been transferred under pressure.

The staff of 40 includes both highly qualified scientists and engineers with expertise in underwater technology, thus combining the theoretical knowledge of university-trained individuals and the practical experience of those who have actually worked in the field.

Courses are given to divers in advanced first aid, and courses in hyperbaric medicine are given to medical personnel. Courses can be set up as required, in special subjects such as underwater welding and non-destructive testing.

It is also expected that the Institute will house an information center and library.

Operational testing of equipment is one of the most important activities of the Institute. The technical testing facilities include two 500 meter chambers, two 650 meter chambers, one small 3000 meter chamber and an indoor pool. A large platform that will serve as a permanent test site will be installed on the sea floor 100 meters from the dock, at a depth of 30 meters. Instrumentation will be such that test data can be monitored and registered from the laboratory.

The leading physician of the Institute, Dr. J. Grimstad, underwent a year's training at the F. G. Hall Environmental Laboratory at Duke University, where he did hyperbaric research under the direction of Dr. Peter B. Bennett.

During 1977, much work was done on developing and refining instrumentation for the measurement of carbon dioxide, volume and gas flow parameters, in divers' pulmonary ventilation, blood pressure, metabolic diluent components of breathing gas and free gas in the blood during decompression. The Institute has been working in cooperation with other Norwegian research institutions on these projects.

It is expected that in the future, the Institute will take an active part in the development of operational systems that will extend human sensing and manipulative capabilities under water. To perform operational tests in the ocean, a support vessel will be required. This vessel will be equipped with lifting gear and instrumentation to permit bell diving as well as the launching and retrieval of underwater vehicles and equipment.

In 1977 the Institute carried out a safety study of operational procedures for a dive to 320 meters during which a pipe welding task was performed. (MFW)

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## HYPERBARIC OXYGEN CONFERENCE TAPES

Cassette tapes on the Third Annual Conference on Clinical Application of Hyperbaric Oxygen held in Long Beach, CA. on 8, 9, 10 June 1978 are now available.

The entire set consists of 22 tapes representing approximately 30 hours of recordings from over thirty presentations.

Cost of this entire set is $75.00 USA, $85.00 Overseas. Also a limited number of the published abstracts from the conferences' original presentations are available for $1.00 each. Please make all checks or money orders payable to Baromedical Foundation upon ordering. For further information and/or orders please write to:

G.B. Hart, M.D., Director
Baromedical Department
Memorial Hospital Medical Center
2801 Atlantic Avenue
Long Beach, CA 90801

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## HYPERBARIC OXYGEN CONFERENCE AUDIO-VISUAL TAPES

Audio-Visual tape presentations during the Nursing Workshop at the Third Annual Conference on Clinical Application of Hyperbaric Oxygen held in Long Beach, CA. on 8, 9, 10 June 1978 are also available.

Procedure for I.V. Infusion during OHP.
10 Minute Audio-Visual Tape ---------- $100.00

Procedure for Physiological monitoring during OHP.
10 Minute Audio-Visual Tape ---------- $100.00

Patient Orientation to OHP.
20 Minute Audio-Visual Tape ---------- $120.00

Pre-View ONLY. (rental fee will apply to cost of order if ordered within 30 days of Pre-View.) ---------- $ 25.00ea

NOTE: THREE TAPES FOR $300.00

Please make all checks or money orders payable to Baromedical Foundation upon ordering. For further information and/or orders please write Dr. G.B.Hart, as above.

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## MONOPLACE HYPERBARIC CHAMBERS

The editor of Pressure received a letter from Vickers America Medical Corporation, P.O. Box 101, U.S. Highway 22, Whitehouse Station, N.J. 08889, saying that they still manufacture monoplace hyperbaric chambers for medical use. In fact they carry six models that meet the safety codes and standards for pressure vessels. Inquiries are welcome.



## GENERAL PURPOSE SUBMARINE

Kockums Shipyard, Malmo, Sweden, has completed its General Purpose Submarine (GPS), a large work submersible that can operate to depths of 350 meters. Its chief function is seen to be the repair and maintenance of gas and oil pipelines.

The GPS has a displacement of 1250 tons; it is 62 meters long, and carries a crew of 26, eight of whom are divers. Its range is 1000 nautical miles, and it can stay at sea for 72 hours. Speed is 8 knots on the surface and 5 knots submerged.

The twin saturation diving system permits two four-man teams of divers to work around the clock.

The submersible is equipped for dry habitat welding, can handle pipes of 91.4 cm. diameter and has a payload of 80 tons.

Kockums is now looking for a combination of companies working in the North Sea who would be willing to assume part of the investment cost in order to have the GPS available. (MFW from Sea Technology, June 1978)

BBB

## SCUBA ACCIDENTS IN NORTHERN CALIFORNIA

Dr. Takashi Hattori reports on 114 scuba accidents seen during 1977 and thru 15 March 1978 at the Community Hospital of the Monterey Peninsula, California.

Of the 114 there were 35 " in trouble", 26 "near drowning" and 22 who "drowned". In addition to these 83, there were 15 cases diagnosed as decompression sickness and 16 cases of air embolism.

Of the 15 cases of decompression sickness, 11 were classified as Type I and 4 as Type II. Of the Type II cases one had "staggers", one "chokes" and two had spinal cord involvement.

There were three deaths among the 16 cases of air embolism. The symptomatology varied from unconsciousness and death to right arm weakness with hyperesthesia over the deltoid. It is of particular interest to training groups that there were 16 accidents during the first ocean dive with three non-fatal cases of air embolism during free ascent. The cause of the five fatal cases occurring during the first ocean dive was listed as: medication (1), cardiac (1), air embolism (1), and unknown (2).

## CAVE DIVING

For information concerning cave diving workshops that are held all over the country, write Sheck Exley, Chairman, National Speleological Society Cave Diving Section, 1591 South Lane Ave., Apt. #118 C, Jacksonville, Florida 32210. The next one will be held in December, 1978, in Branford, Florida. These workshops include lectures, discussions, and films on various aspects of cave diving, as well as guided practice dives under the supervision of highly experienced cave divers. The workshops constitute an excellent intermediate step between conventional open water scuba training and specialized cave diving training.

Another intermediate step is the "cavern diving"' course offered by the Professional Association of Diving Instructors (PADI). This qualifies open water divers for "ledge diving" in the areas near and just inside of cave entrances.

Final training for cave diving is given by the YMCA, NAUI, and the NACD (National Association of Cave Divers). The YMCA probably has the most active program. For information, write: Mary Melton, Rt. 1, Box 175-M, Vero Beach, Florida 32960.

Another way to learn cave diving is to work directly with an experienced cave diver who is also a qualified instructor. This one-on-one technique is probably more effective than class teaching in cave diving.

The bi-monthly newsletter of the NSS Cave Diving Section, Underwater Speleology, often contains articles on the latest developments in cave diving equipment and procedures. This is available for $5.00 per year from Stephen Maegerlin, P.O. Box 60, Williams, Indiana 47470. Most publications on cave diving are somewhat out of date. One that is not is Hand Signals for Cave Diving, by Claudette Linley, available from Dave Desautels, 12900 N.W. 29th Ave., Gainesville, Florida 32601. It is hoped that a new manual on cave diving will be in print shortly. (MFW from an article by Sheck Exley in Sport Diver, Second Quarter 1978).

## UNDERWATER TRAINING IN THE UK: Progress Report

In a recent progress report, Developments in underwater training, the Manpower Services Commission, (MSC) summarizes progress during the last three years in commercial diving training in the UK. Training standards have been published for basic air diving and for mixed gas diving. The Underwater Training Centre (UTC) has been set up at Loch Linnhe, Scotland. A National System of Certification for Trainee Divers has been published. Three diving schools other than the UTC, have been approved for basic air diving. Fort Bovisand Underwater Centre near Plymouth, Prodive Ltd. near St. Austell, Cornwall, and the Royal Engineers Diving Establishment near Southhampton. The UTC is the only one approved for mixed gas diving at present.

Aptitude tests and selection procedures are being evaluated at Stirling University.

The MSC is moving toward addressing the problem of international recognition of diver training certificates.

Grants are being offered by MSC to employers sending trainees to approved basic courses, and also in some cases directly to qualified non-sponsored individuals for attending mixed gas courses. Information regarding grants may be obtained from: Training Services Division (IDSM), Manpower Services Commission, 162/168 Regent Street, London W1R 6DE, London, United Kingdom. (MFW from an announcement in the Journal of the Society for Underwater Technology for June 1978).

## SUB SEA 78 SYMPOSIUM

The 6th Annual Sub Sea Symposium will be held on October 14, 1978, at the U.S. Coast Guard Academy, New London, Connecticut 06320. The program calls for Seminars from 0900 to 1700 and for Film Review at 1900. Please contact:

Charles Dennis
U.S. Coast Guard Academy
New London, Connecticut 06320

# PRESSURE

Newsletter of the

## UNDERSEA MEDICAL SOCIETY, Inc.

(A NON-PROFIT ASSOCIATION)
9650 Rockville Pike Bethesda, Maryland 20014 U.S.A.
(301) 530-9225

Vol. 7 No. 4

An International Society: To provide a forum for professional scientific communication...[in] life sciences and human factors aspects of the undersea environment.

August 1978


*UMS TO BE GUEST SOCIETY AT APS FALL MEETING*

The 1978 Fall Meeting of The American Physiological Society will be held in conjunction with The American Society of Zoologists (Division of Comparative Physiology and Biochemistry), with the Undersea Medical Society as a guest society, at the Chase Park Plaza Hotel, St. Louis, Missouri. Registration is Sunday, October 22, 2-10 P.M.; Scientific Sessions Monday, October 23 through Friday, October 27. On Wednesday afternoon there will be a champagne tour of the city followed by cocktails and dinner on the Goldenrod Showboat. Also planned for Wednesday afternoon is a refresher course on Smooth Muscle Physiology.

Drs. Herbert A. Saltzman and Hermann Rahn have planned a symposium for Monday afternoon, October 23, on "Man as an Aquatic Mammal: Physiological Effects of Increased Ambient Pressure and Immersion." Papers will be presented by Drs. G. L. Kooyman, C. E. G. Lundgren, H. A. Saltzman, P. B. Bennett, and A. G. Macdonald. There will be discussion following each paper.

For advance registration forms and official forms for hotel reservations, write: The American Physiological Society, 1978 Fall Meeting Office, 9650 Rockville Pike, Bethesda, MD 20014.

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### NOMINATIONS FOR UMS AWARDS

Dr. Eric P. Kindwall, Chairman of the Awards Committee, requests nominations for the four awards presented annually by the Undersea Medical Society. They are:

The Albert R. Behnke, Jr. Award, for outstanding scientific contributions to advances in manned undersea activity.

The Oceaneering International Award, for outstanding contributions to the advancement of commercial diving in the areas of increased safety or performance.

The Stover-Link Award, for recent significant contributions to undersea biomedical research.

The Craig Hoffman Award for outstanding contributions to diving safety.

Please send nominations to:

Eric P. Kindwall, M.D.
Director, Department of Hyperbaric Medicine
St. Luke's Hospital
2900 West Oklahoma Avenue
Milwaukee, Wisconsin 53215

### NOMINATIONS FOR UMS OFFICERS

If you have a candidate you want to see on the ballot for President-Elect, Vice President, Treasurer, Secretary, or Member-at-Large, please follow the procedure indicated in Article I of the Bylaws, as stated on pages ix-x of the UMS 1978 Handbook and Membership Directory. Petitions must be in the Secretary's hands prior to 31 December 1978. The Secretary of the Society is: Merrill P. Spencer, M.D.

The Chairman of the Nominations Committee, Jefferson C. Davis, M.D., would also welcome suggestions regarding any of these offices. Addresses for Drs. Spencer and Davis may be found in the Directory.

# Offshore Technology

THE MILITARY ENGINEER
September-October 1978

## Findings from Deep-ocean Mining Environmental Study Are Encouraging

NOAA's DOMES program entered its second phase in the spring of 1978 when NOAA scientists began monitoring deep-ocean test mining operations in the Pacific Ocean. Earlier work established base lines for marine life and environmental conditions at candidate manganese nodule sites. In June 1978, the Department of Commerce's Pacific Marine Environmental Laboratory reported that there is no serious impact on the marine ecosystem resulting from the harvest of manganese nodules from the Pacific Ocean floor.

The scientists, working with the NOAA ship *Oceanographer* and the SEDCO 445, found little persistent effect from mining operations. The SEDCO[1] was mining in an area 865 nautical miles southeast of Hawaii in water about 15,000 feet deep.

Monitoring included sampling and measurements taken along the sea floor and around the surface plume of sediments discharged by the mining ship as well as in the water column between the sea floor and the surface. Comparisons were made between light and nutrient levels and other factors in the discharge plumes and corresponding measurements of the undisturbed ecosystem outside the plume.

The effect of the mining ship's collector on the sea floor was also observed with deep-sea cameras, and box cores were taken of the distributed sediments to determine changes in the kind of life forms in and out of the plumes found there. These samples were collected for subsequent laboratory comparison.

Preliminary analysis of benthic (sea-floor) plume data indicates that this plume did not go far upward into the water column, rising no more than a few tens of meters above the bottom. However, the plume may increase in thickness with time and distance from the collector.

No evidence was found of significant lateral spreading in the benthic plume, although there were tentative indications that the plume moved horizontally, carried on slowly moving, deepwater currents. Considerable current-meter data remain to be analyzed, however, before conclusions can be drawn regarding the movement of the benthic plume.

The investigators found evidence of a rather rapid resettling of disturbed material near the mining collector. This "repiling" of the disturbed material near its point of origin suggested that the benthic plume did not migrate over a broad area.

Surface plume data suggest that much of the particulate sediments discharged by the mining vessel at the surface settled out of the surface plume and returned to the sea floor. Dissolved constituents in the surface plume could be detected for periods of a few hours; neither particles nor chemical differences could be detected in plume water more than about 24 hours old. This may mean that surface plume effects are transient, with no detectable difference between plume water and undisturbed water a day or two after mining.

It is still unsure as to whether discharged material accumulates at the pycnocline, a marked change in water density at about 180 feet which separates the well-mixed surface waters from the denser ones of the deeper sea.

Another question is how this remote but important corner of the global ecosystem will be affected by not one but fleets of mining ships. Preliminary answers may come from further analysis of data obtained during this year's study.

The scientists plan to revisit the area periodically to assess the rate at which the ecosystem recovers from nodule mining disturbances. Results from this, and a more detailed analysis of monitoring activities this spring, will be published later.

[1] Owned by Ocean Management, Inc.

## Diving System Reduces Decompression Discomfort

The Naval Medical Research Institute (NMRI), Bethesda, Maryland, and the Admiralty Marine Technology Establishment Physiological Laboratory, Alverstoke, England, are conducting a biomedical assessment of JIM, a one-atmosphere diving system.[2]

Based upon a special joint design which permits suit flexibility at 1,250 feet, the system weighs 1,100 pounds in the air and approximately 60 pounds in water. It is lowered to the ocean floor and raised to the surface on a tether. The operator breathes one-atmosphere air which is scrubbed of carbon dioxide and augmented with pressurized oxygen to make up the oxygen consumed by the operator. Communication is provided either by a hand wire or acoustic system.

The suit is composed of a body constructed of magnesium alloy while the joints and elbow spacers are composed of aluminum alloy forgings. The joints are o-ring sealed spherical ball types filled with vegetable oil. O-ring failure causes the joints to seize up but will not cause loss of suit integrity. The external pressure causes the failed joint components to seat against each other.

This unique design permits placing an engineer, technician, or observer on the ocean floor without the decompression burden normally placed on divers who operate at ambient pressures. Although the concept of one-atmosphere diving systems is old, the advances in scuba equipment and saturation diving techniques held back their development until the costs to dive deep became so great.

[2] By Oceaneering International, Inc.

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# The MILITARY ENGINEER

SEPTEMBER–OCTOBER 1978/VOLUME 70/NUMBER 457

The ROTC Today, page 314



*J. M. Walsh, Ph.D.*
*Naval Medical Research Institute*

The title of this article may sound somewhat ominous, so I'd like to define and clarify what I mean when I talk about "drugs." Drugs come in many forms: they can be ingested, injected, inhaled, and even absorbed through the skin—and we are concerned about all of them.

This discussion will not be restricted to street drugs or to prescribed medications, because we want divers to realize that many substances affecting body chemistry (e.g., aspirin, nasal sprays, alcohol, nicotine, caffeine) are not generally thought of as drugs—but probably should be.

If you follow the scuba literature, you probably have decided, as I have, that there are two schools of thought concerning the use of drugs while diving. The Navy provides no specific instructions concerning medication and fitness for duty; the diving supervisor makes his decision based on the recommendation of the diving medical officer (DMO), and that recommendation may vary considerably from one DMO to another. Some say there are a variety of drugs available that will counteract most motion problems and, if you are unaffected by these drugs on the surface, you will be okay in the water. In direct contrast, many DMO's believe that under no circumstances should a diver *ever* take *any* kind of drug within twenty-four hours before diving.

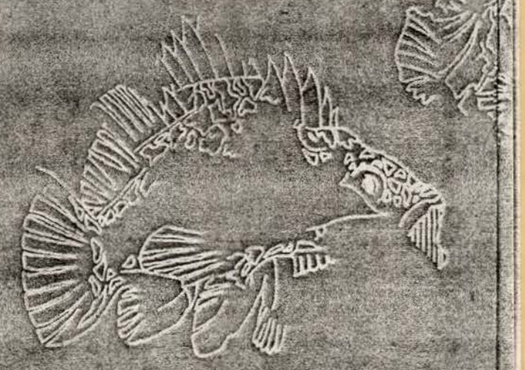
However, it seems to me that there's room for discussion between these opposite opinions. So, I'd like to spend the next few paragraphs examining the facts and trying to evolve some logical recommendations and conclusions.

To begin with, there are many variables that alter the effects of drugs. In reality, there is no such thing as "a drug effect," because a drug never acts exactly the same in all individuals, or even in the same person on different occasions. The action of a drug depends, to a large extent, on the physiological and psychological makeup of the individual at the time the drug is administered and on the prevailing environmental conditions. A partial list of the kind of variables that can modify drug action is shown in Table 1.

Any drug can be toxic if you take enough of it, and people vary widely in sensitivity—so much so that an appropriate dose for one person can be an overdose for another. Let's consider what happens physiologically and biochemically when we dive. In the underwater environment we are subjected to: 1) increased hydrostatic pressure, 2) varying partial pressures of $N_2$ and $O_2$ in compressed air, and 3) the interaction of changing gas and pressure with all of the variables mentioned above.

Pressure itself can exert numerous changes in our body chemistry. Many effects are obvious only at very high pressures, but even at the depths that divers are accustomed to, the increased workload of breathing under pressure can cause $CO_2$ buildup from reduced gas exchange and changes in blood constituents can occur. Cell membranes undergo pressure-induced changes, which may account for numerous hyperbaric phenomena, for example, nitrogen narcosis. Even oxygen, which is needed to sustain life, becomes toxic and can cause pulmonary damage and convulsions when the partial pressure is raised sufficiently. Research dives have shown that metabolic, hormonal, neurological, and cardiovascular changes occur at depths as shallow as 90 fsw.

When you plan to dive, you must remember: Changes in your body are going to occur during the dive, and this makes it tough to predict how a drug will act because so much depends on your physiological state and the environment, both of which are continuously changing. Even under carefully controlled conditions in our labora-



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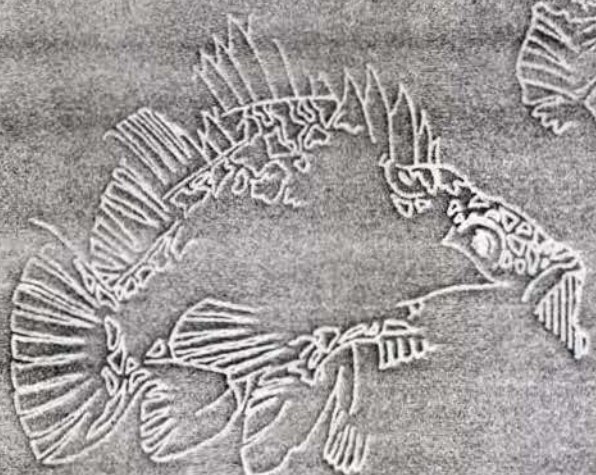
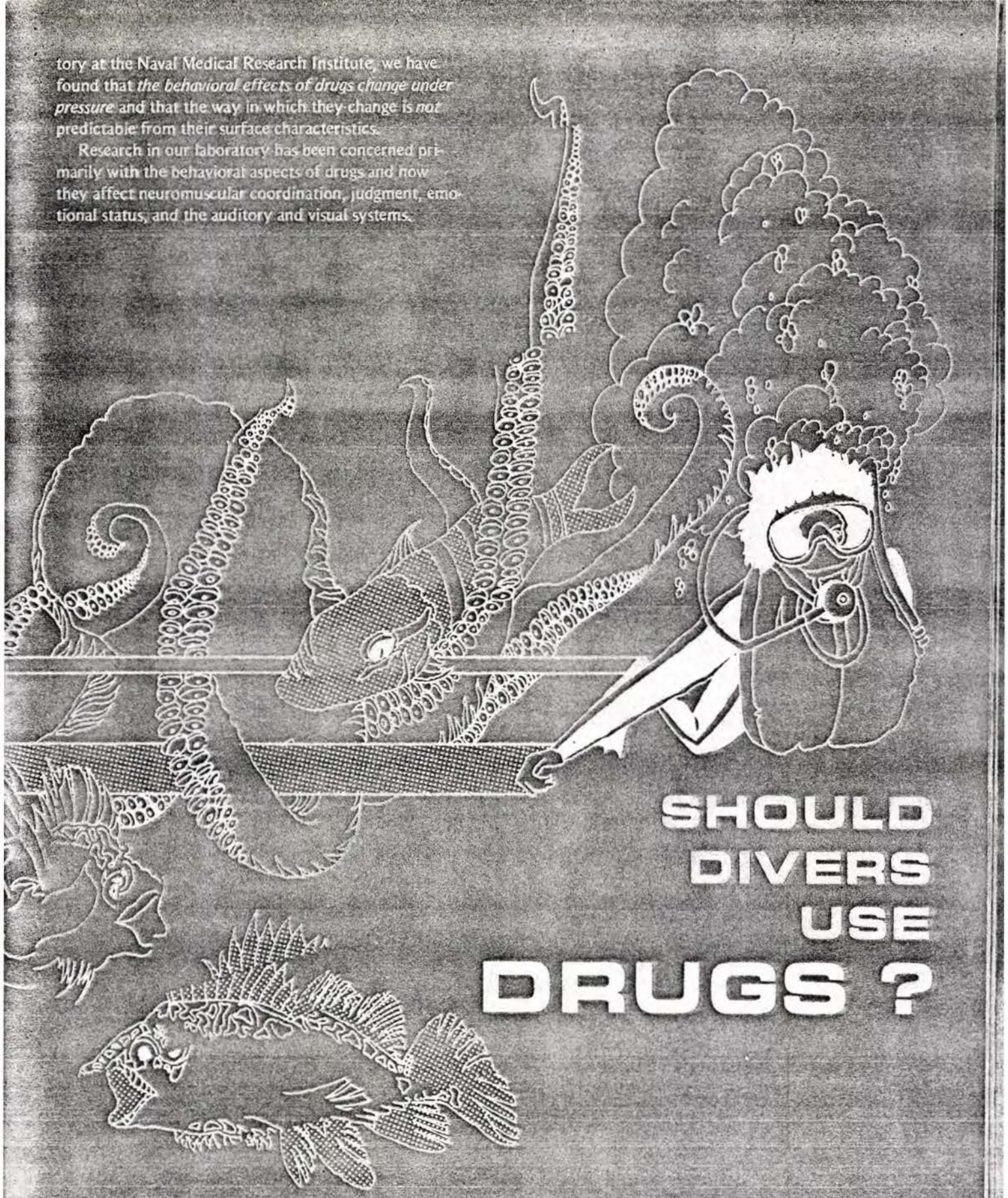


tory at the Naval Medical Research Institute, we have found that *the behavioral effects of drugs change under pressure* and that the way in which they change is *not* predictable from their surface characteristics.

Research in our laboratory has been concerned primarily with the behavioral aspects of drugs and how they affect neuromuscular coordination, judgment, emotional status, and the auditory and visual systems.



# SHOULD DIVERS USE DRUGS ?

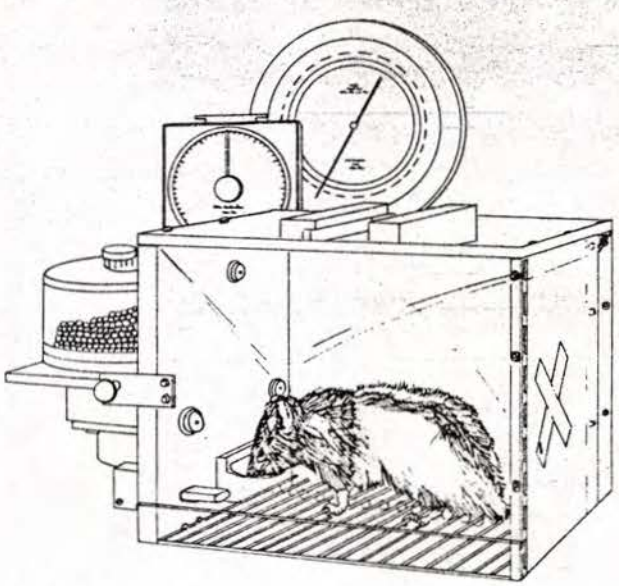
**" . . . the behavioral effects of drugs change under pressure and the way in which they change is not predictable from their surface characteristics."**

Our work has focused on three areas: 1) use of drugs to provide hyperbaric medical treatment for divers (e.g., in recompression therapy, and for emergency treatment requiring drugs that would work effectively and safely under relatively high pressures—i.e., up to 1,500 fsw); 2) use of drugs to maximize the number of men available for duty and to prevent the onset of hyperbaric disorders (e.g., a safe, effective drug for sinus problems, or something to prevent nitrogen narcosis); 3) unauthorized use of drugs (e.g., self-medication, drug abuse, or excessive consumption of substances that may be harmful, such as alcohol or caffeine).

The program is designed to comparatively evaluate drug compounds, beginning with studies involving small animals (usually rodents) and then thoroughly evaluating the substance in larger animals (monkeys or dogs) before testing it in human divers. The animals and humans are trained to perform similar complex tasks; then they are treated with the drug and exposed to normal and increased pressure conditions in a dry hyperbaric chamber. Because there are thousands of drugs available on the market, we have selected representative compounds from major drug classes for test and evaluation.

Results of these evaluations have demonstrated how widely the effects of drugs vary when introduced to the hyperbaric environment. Some specific observations follow (* indicates statements based on information where human evaluations have been conducted).

• *Analgesics.** Aspirin and Acetaminophen (Tylenol) have been tested at depths to 180 fsw, and even moderately high doses (3-4 tablets) have not produced behavioral or physiological problems.



• *Antihistamines.** (Benadryl) At prescribed doses we have consistently observed decreased performance, mental clouding, and reduced fine-motor coordination.

• *Decongestants.* (Sudafed) Behavioral effects of decongestants under pressure are not as toxic as those observed with the antihistamines, although we have seen some slowing of judgment and coordination. In addition, researchers and clinicians suggest that decongestants may predispose divers to cardiac arrhythmias.

• *Depressants.* Pentobarbital and alcohol have been evaluated, and the effects did not appear to get worse under pressure. However, alcohol intoxication, which can cause nausea or vomiting, would certainly be a problem for the diver.

• *Diuretics.* No behavioral effects have been observed at normal doses.

• *Hallucinogens.* Delta-9-tetrahydrocannabinol (THC), the active ingredient in marijuana, was evaluated in animals. The effects of marijuana, which interferes with cognitive processing and neuromuscular control, get worse under pressure, and these effects are magnified as the partial pressure of oxygen increases.

• *Motion Sickness Remedies.* Dramamine*, an antihistamine-type motion-sickness preparation, which is actually a combination of antihistamine and stimulant, does not appear to produce any significant behavioral problems at depths to 180 fsw.

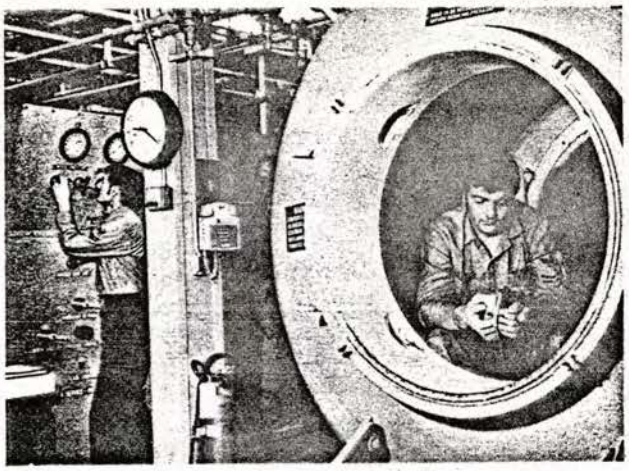
• *Stimulants.* Dexedrine, Methedrine, and the antidepressant Monoamine-oxidase-inhibitors interact with pressure conditions to interfere with judgment and muscle coordination at depths as shallow as 50 fsw. These drugs also may have undesirable cardiovascular effects.

• *Tranquilizers.* Chlorpromazine, Librium, and Valium caused changes in the dose-response curves from animal subjects when these compounds were evaluated under pressure. The magnitude of the effect was dose- and pressure-dependent. In addition, although we have no data for humans, lack of alertness or overconfidence resulting from tranquilizers would certainly be troublesome at 100 fsw.

**"The effects of marijuana . . . get worse under pressure, and these effects are magnified as the partial pressure of oxygen increases."**

Now, these findings need qualification:

1. Although the studies were carried out under carefully controlled laboratory conditions, they were not done in the water, and the addition of that factor and its associated variables (e.g., cold, anxiety, fatigue) certainly could alter the effect of drugs.



Performance test subject MM1(DV) Chuck Bonner (right) and GMG2(DV) Don Sayre at console of NMRI's hyperbaric test facility.

2. As you've seen, we have not completed all of the evaluations with humans. Some of the conclusions are based on animal research, and, therefore, direct inferences about humans must be made with caution.

In summary, there are three important facts that you should remember when you plan a dive: 1) Changes in your body chemistry occur while diving; 2) many variables affecting drug action can come into play during a dive; and 3) the interaction of these facts (1 and 2) cause drugs to change unpredictably.

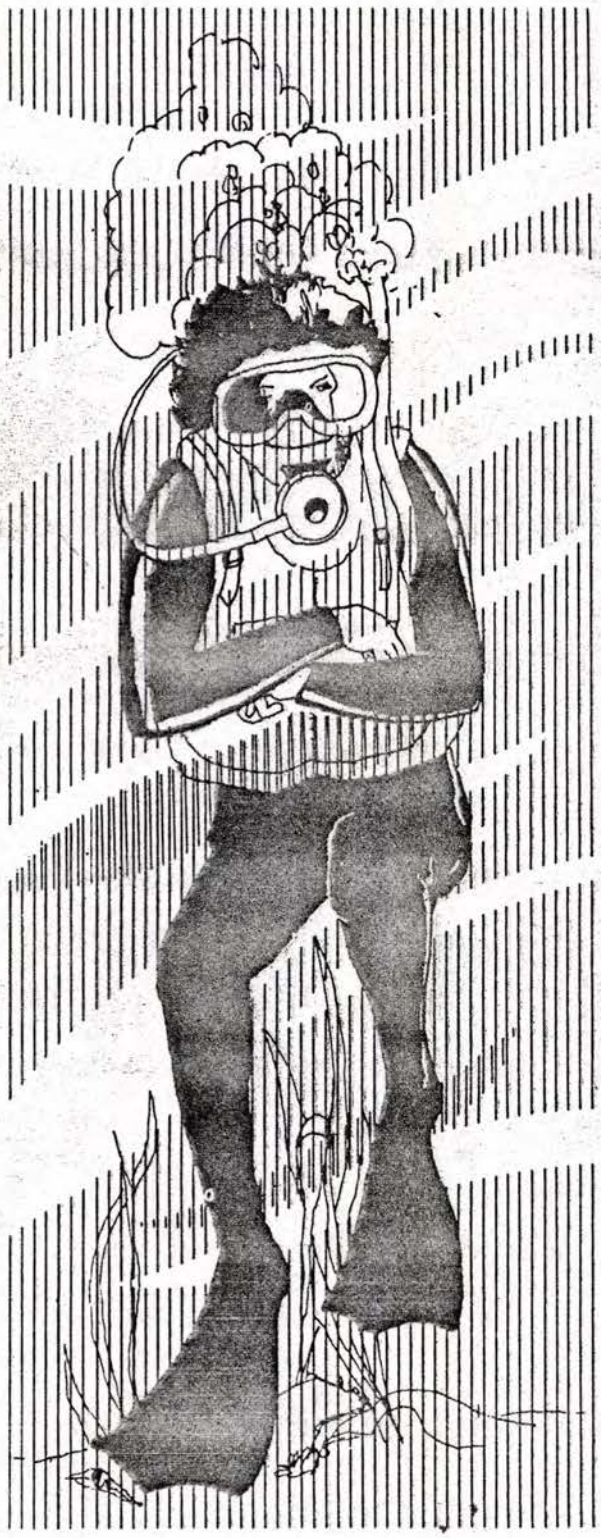
Recommendations

- It would be wise to avoid *all* drugs while diving.
- Remember that over-the-counter preparations can be as toxic as prescription or abused drugs.
- If you must dive under medication, be informed. Get full information from your diving medical officer, realize that even the most benign compound may become behaviorally toxic under pressure, and dive with extreme caution.

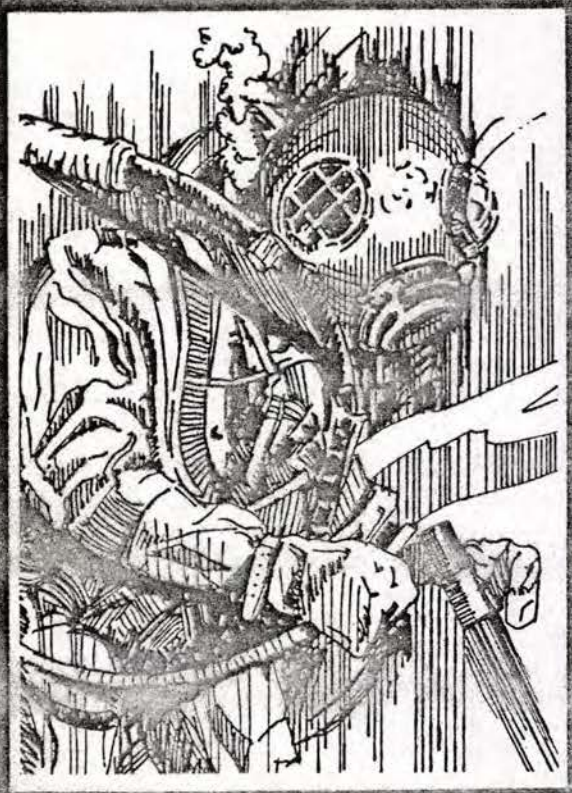
TABLE 1
PARTIAL LIST OF VARIABLES THAT CAN AFFECT DRUG DISPOSITON IN A DIVER

| EXTERNAL | INTERNAL | PHARMACOLOGICAL |
|---|---|---|
| Breathing gas | Age | Acute vs. chronic |
| Current | Allergy | Administration route |
| Diet | Anxiety/panic | Bioavailability |
| Pressure (depth) | Cardiovascular function | Dose |
| Pressure x gas interaction: | Circadian rhythm | Excretion |
| Nitrogen narcosis | Disease state | Metabolism |
| Oxygen toxicity | GI function | Presence of other drugs |
| $CO_2$ intoxication | Infection/fever | Tolerance |
| Visibility | Pregnancy | Vehicle |
| Water temperature | Weight | |

"It would be wise to avoid all drugs while diving . . . Even the most benign compound may become behaviorally toxic under pressure."



# FACEPLATE



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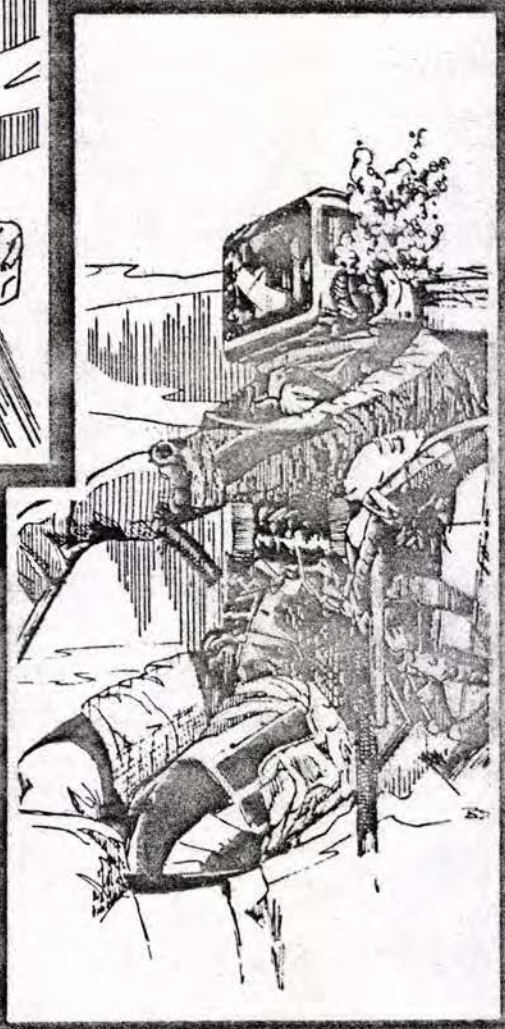
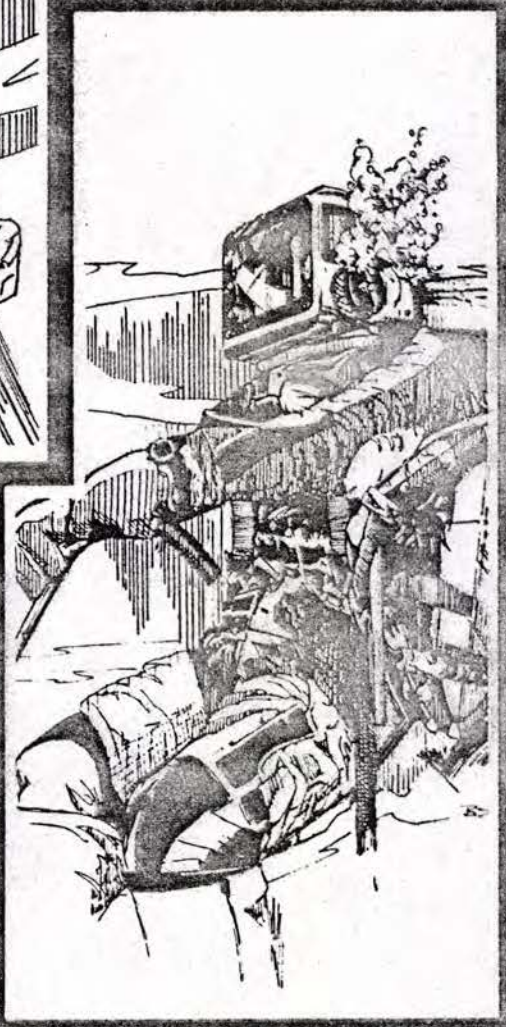


## 10TH ANNIVERSARY ISSUE

# FACEPLATE

SPRING
1979



## 10TH ANNIVERSARY ISSUE

ON THE
# Surface
NAVAL SURFACE WEAPONS CENTER
DAHLGREN, VA. • WHITE OAK, MD.

VOLUME 2, NO. 23 22 JUNE 1979

## Weapons Tank used for TV film making

White Oak's Undersea Weapons Tank was the scene for some late-night diving and underwater movie-making recently as Navy divers and technicians from the Naval Medical Research Institute (NMRI) took advantage of the tank's clear water, excellent lighting, and 100-foot water depth.

NMRI conducts biomedical research and has been using the tank—a unique facility in this area—for buoyant ascent training of Navy divers. They are using "JIM," a one-atmosphere diving system.

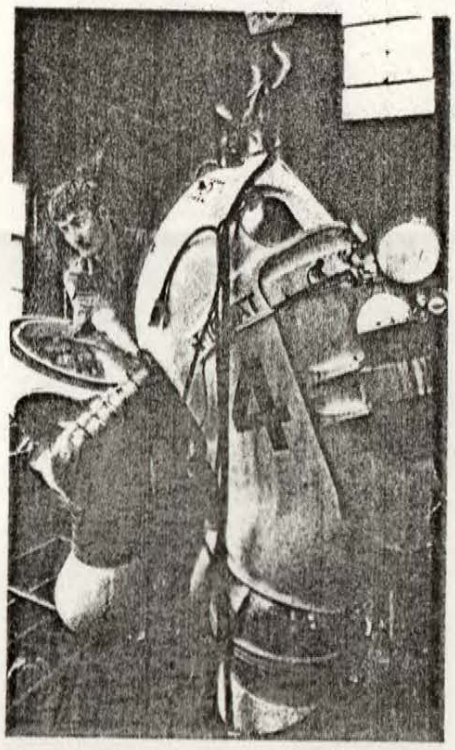
NMRI leased JIM from Oceaneering International, Inc., for their research and at the same time they assisted the world famous diver photographer Al Giddings, who was here to shoot film for an ABC television documentary. *The Descent: A Chronicle of Undersea Man*, will be a two-hour epic film that will examine the history of diving in all its depths. JIM will be featured.

Giddings, who has developed his own housings and lighting systems for much of his underwater camera work, feels to shoot sequences for the documentary film. In Hawaii, he will photograph open sea operations at 1500-foot depths using a more advanced version of JIM.

The film will be televised next Spring. Look for it.

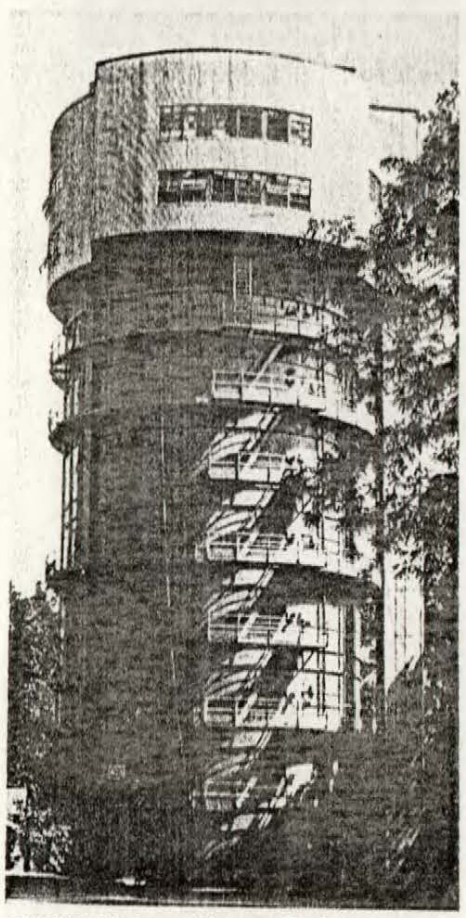
*JIM is readied for a plunge in the tank by NMRI personnel.*

# Weapons Tank used for TV film making



*JIM is readied for a plunge in the tank by NMRI personnel.*

*Diver/photographer Al Giddings*



*NSWC's Undersea Weapons Tank.*

Photos by Fred Figall

White Oak's Undersea Weapons Tank was the scene for some late-night diving and underwater movie-making recently as Navy divers and technicians from the Naval Medical Research Institute (NMRI) took advantage of the tank's clear water, excellent lighting, and 100-foot water depth.

NMRI conducts biomedical research and has been using the tank—a unique facility in this area—for buoyant ascent training of Navy divers. They are using "JIM," a one-atmosphere diving system.

NMRI leased JIM from Oceaneering International, Inc., for their research and at the same time they assisted the world famous diver photographer Al Giddings, who was here to shoot film for an ABC television documentary. *The Descent: A Chronicle of Undersea Man*, will be a two-hour epic film that will examine the history of diving in all its depths. JIM will be featured.

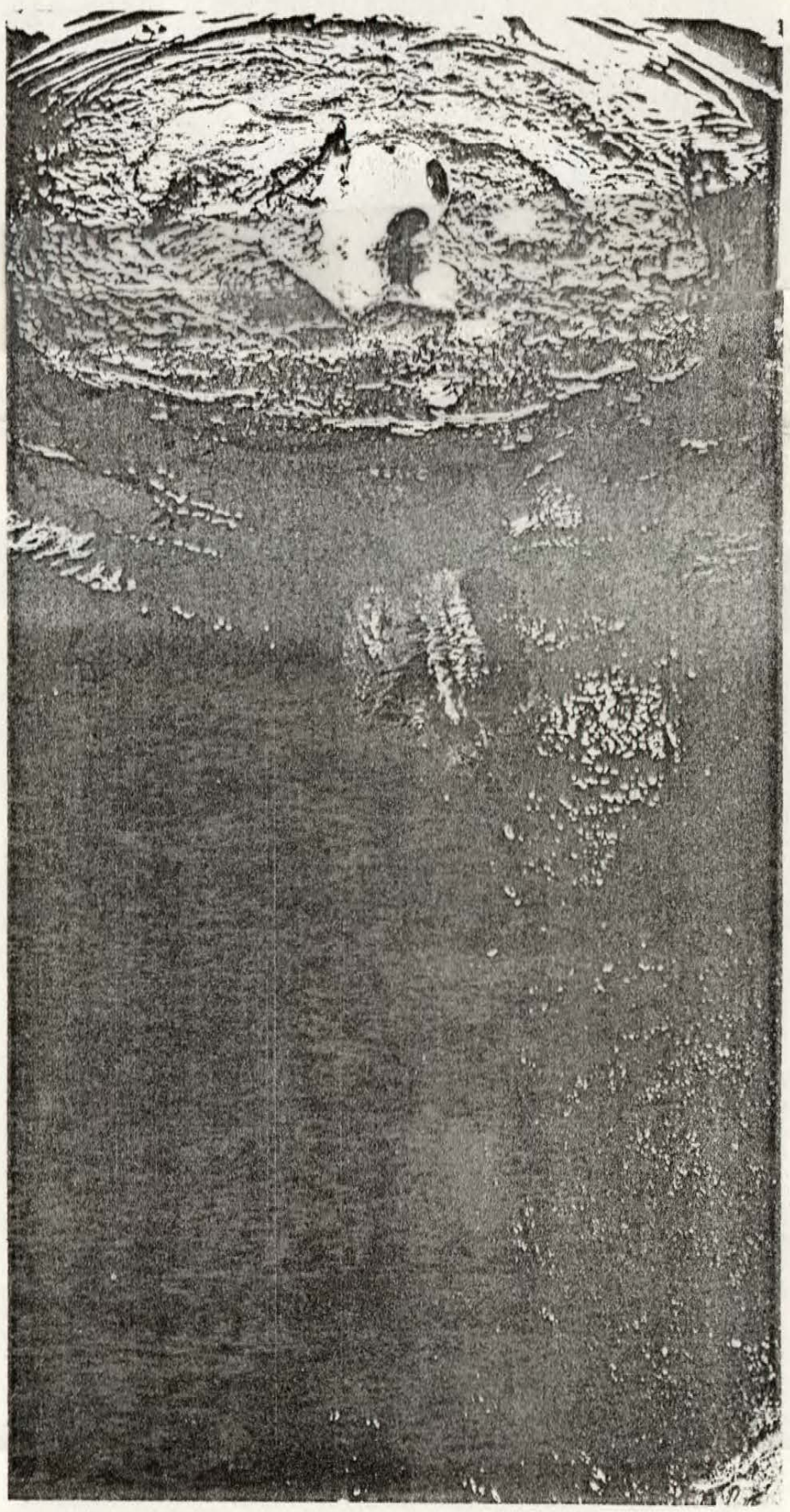
Giddings, who has developed his own housings and lighting systems for much of his underwater camera work, feels more at home in the water than out, and is a foremost authority on deep-water photography. He shot most of the footage for the 1977 film *The Deep*, and has been credited with numerous other undersea films of wide acclaim.

Dr. Art Bachrach, NMRI's Chief of Behavioral Sciences, accompanied the Navy diving team for the filming at White Oak. He told *On the Surface* that the Undersea Weapons Tank "is the only one of its kind in the area that we can use for our buoyant ascent training." The controlled lighting, 100-foot depth, and movable grid "are important features that make the facility attractive for our work," he added.

JIM was put through his paces for descent, buoyancy, and bottom-walking as Giddings skillfully dove and maneuvered to capture the action on film. To shoot the scenes, a diver climbs inside the huge JIM suit, and is lowered by crane above the water surface. Cameras rolling, lead-weighted JIM descends 100 feet to the tank bottom with Giddings in wet pursuit. The diver in JIM can walk on the tank floor and can even pick up a dime with the aid of mechanical clamps. JIM drops his weights, becomes free-floating, and rises to the water surface. The diver breathes his own air and can stay submerged with JIM for up to 27 hours if necessary with the aid of $CO_2$ scrubbers.

Giddings is traveling the world's seas to shoot sequences for the documentary film. In Hawaii, he will photograph open sea operations at 1500-foot depths using a more advanced version of JIM.

The film will be televised next Spring. Look for it.



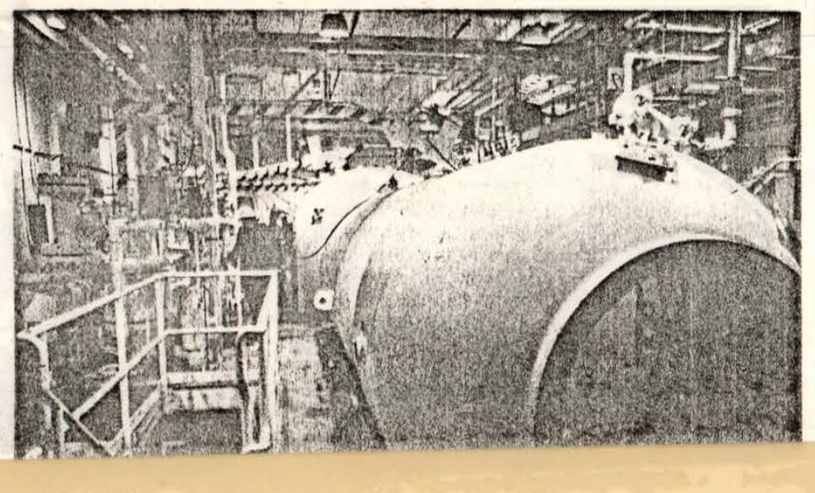
*Giddings pursues JIM underwater during a filming sequence.*

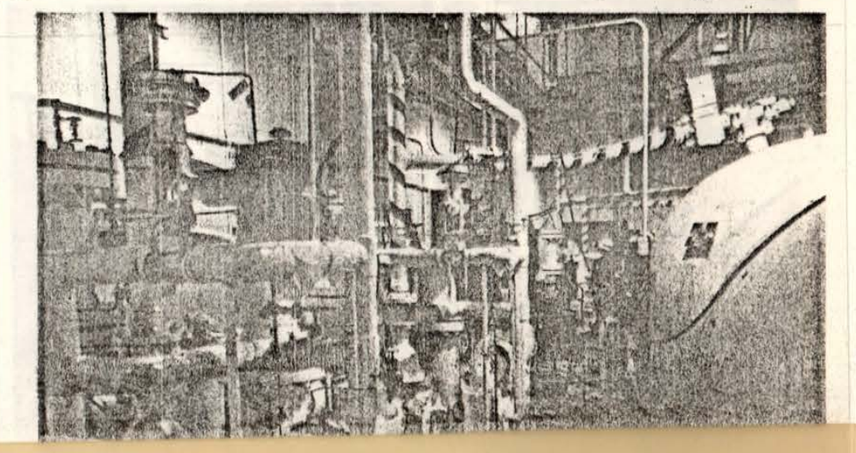
Volume 4
Number 33
August 25, 1979

# The Washington Building Craftsman

Official Publication of the Washington Building and Construction Trades Council, AFL-CIO

## Local 602 Steamfitters Aid Navy's Deep Sea Research Program





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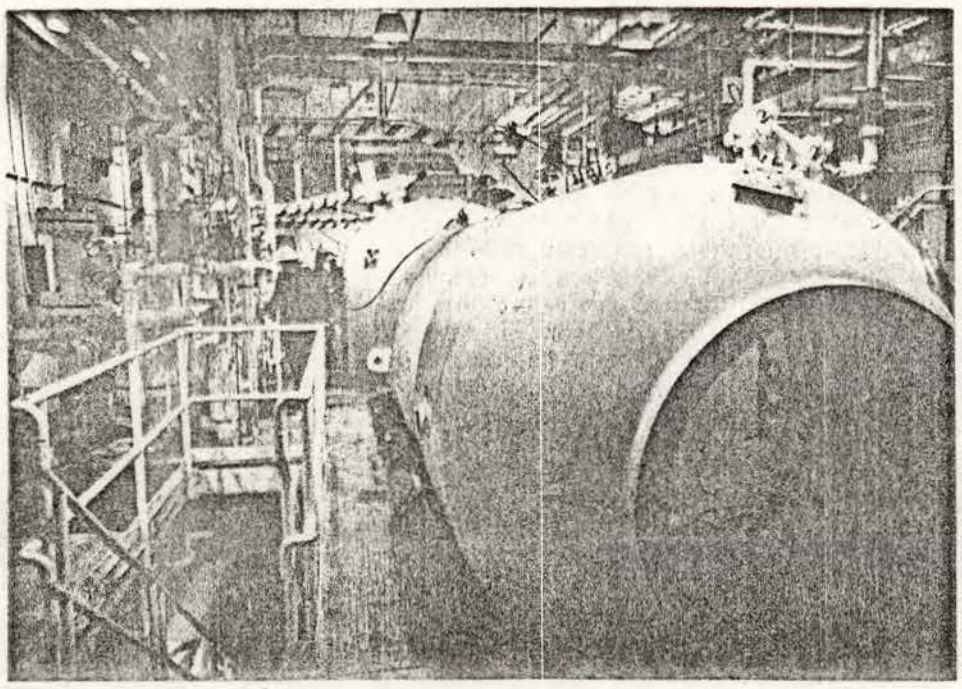

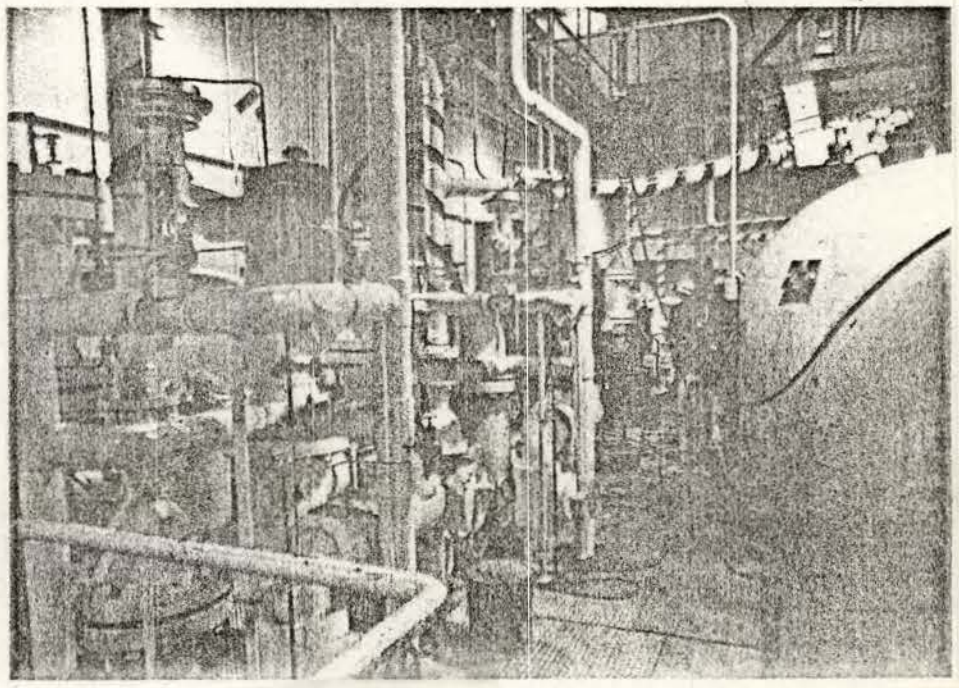

The steamfitters are helping the U.S. Navy really put the pressure on for more research. The research will be done at the Hyperbaric Research Facility chamber complex in Bethesda, Md., where approximately 25 steamfitters from Local 602 have been working on the newest addition to the Naval Medical Research Institute (NMRI).

The Hyperbaric Research Facility houses a hyperbaric (high pressure) complex capable of simulating ocean depths down to 3,400 feet for both human and animal diving research.

The complex features the most recent developments in chamber design and construction. It includes five separate dry chambers; a wet diving chamber mounted vertically beneath the center chamber; and the necessary systems for life support, operating control, communication, fire protection, water conditioning, instrumentation, and data acquisition. Three separate atmosphere conditioning systems control chamber temperature, humidity, oxygen, make-up, and the removal of carbon dioxide, particulate matter, and contaminants.

Three of the dry chambers and the wet chamber are rated to 1,000 psi; the other two dry chambers can be pressurized to 1,500 psi. The dry chambers have been designed to support diver habitation for 90 days. Each dry chamber is equipped with receiving ports, service locks for food and supplies, feed-through connections for monitoring instruments, and communication penetrations. It takes six days after the diver enters the chamber for the chamber to reach the desired pressure. Water temperature can be varied from 34° F to 85° F, providing a wide test range for thermal studies.

The specific objectives of the NMRI's hyperbaric research program include the following:

- Define the short- and long-term effects of pressurized, mixed gas environments on a diver's capabilities.
- Reduce to a minimum the risks associated with diving equipment.
- Assess the work and physiology of a diver during compression to and at depths of 2,500 feet of seawater.
- Determine the effects of drugs on divers in a pressurized environment.
- Find out what is needed to extend the Navy's depth capability, reduce the physiological risks associated with decompression, reduce time and cost of diving operations, and extend man's underwater work capabilities.

The steamfitters who have worked on this advanced chamber complex are: Robert Glenn Ahern, foreman, Roland Pearson, Frederick Farrell, John Myre, Roger Dale Ahern, Harold Zepp, George Astlin, George Austin, Roger Liller, Jeff Smith, Mike Southcomb, Ronald Cox, Frank Stull, Robert Perry, Jack Wagner, Leroy Wells, John Taylor, Eric Alison, Bob Eckells, Kenny Hubbard, Tommy Gonzales, Jim Tayman, and Carl Poore. All are employed by John C. Grimberg Co.

Pictures show interior of the NMRI facility.

# PRESSURE

Newsletter of the
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(A NON-PROFIT ASSOCIATION)
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(301) 530-9225

Vol. 8, No. 5

An International Society: To provide a forum for professional scientific communication...[in] life sciences and human factors aspects of the undersea environment.

October 1979

## N.M.R.I. DIVERS

The present contingent of divers at the Naval Medical Research Institute, Bethesda, Maryland, is called upon to perform a variety of tasks in support of biomedical research, in addition to the usual duties associated with a diving facility. Divers at NMRI often are asked to volunteer for diving medical experiments, experiments which may demand the utmost in diver stamina and fortitude. For example, during the past year NMRI divers participated in studies evaluating commonly used drugs (Faceplate, Spring '79), cold water performance, flying after diving, heat loss in water, blood-gas exchange and diver/operator performance in the one-atmosphere diving system. The tasks NMRI divers perform in these studies are rarely pleasant; moreover, the studies may call for extensive physiological monitoring of diver performance via electrodes and probes under conditions of extreme environmental stress (e.g., water temperature, fatigue). Successful biomedical research divers at NMRI exhibit patience in the face of lengthy and involved experimental procedures and a dedication to accomplishing the tasks in an exemplary manner. Without the cooperation and professionalism of the NMRI diver, applied biomedical diving research would falter.

Although no single investigation is typical of the experiments under way at NMRI, a study can be chosen to illustrate the tasks NMRI divers are called upon to perform. Recently, MR1(DV) Weaver participated in a study evaluating the effects of water temperature on physiological, cognitive, and motor performance by a wet-suited, scuba-equipped diver. During the experiment he completed 14 dives in water ranging from 77°F to 41°F. On each dive he performed tasks including top hatch transfer, tooker patch removal and installation, time estimation, learning and memory performance on an underwater response acquisition paddle, and torque wrench estimation. Before each dive ECG electrodes and temperature probes were applied; bottom times ranged from 30 to 50 minutes. The data gathered from this study will assist researchers in understanding the nature and extent of environmental stressors on diver performance. Once validated, this information will be passed on to the fleet with recommendations for appropriate action.

When not actively engaged in a research project, NMRI divers can be found conducting pressure and $O_2$ tolerance tests for U.S. Naval Academy midshipmen and diver candidates, requalification dives for Naval District Washington MC and MSC officers, hyperbaric Vickers treatments for various disorders (e.g., gas gangrene, bone necrosis), requalification dives for NMRI personnel, and recompression treatments for both military and civilian diving accidents. In addition, NMRI divers have the opportunity for travel. Among the TAD locations visited by NMRI research divers in the past year were Isle of Shoals, Maine; San Antonio, Texas; Panama City, Florida; and Columbus, Ohio.

What do the NMRI researchers think of the support provided by the research divers? The comments of Dr. J. M. Walsh are illustrative: "NMRI divers do an excellent job for us. They are cooperative and highly motivated, despite numerous discomforts and indignities they must endure for reliable data to be gathered." The NMRI biomedical research diver fills a unique and important role in advancing our understanding of the effects of hyperbaria on the human body. (Excerpted from an article by M. C. Curley in Faceplate, Summer 1979)

******

# Navy Unit Works To Conquer Deep

By KERRI CHILDRESS
Times Staff Writer

BETHESDA, Md. — The Navy, which has conducted research that has helped man explore the moon and outer space, now is striving to put him deeper in the inner space of the ocean's abyss — and for longer periods of time.

To accomplish this, scientists at a newly developed department of the Naval Medical Research Institute here are working toward a better understanding of the problems man encounters in deep diving, and are searching for methods to combat those problems.

Installation of special hyperbaric chaers (large tanks that can simulate diving conditions up to 3400 feet) constitute the major advantage that today's Navy scientists will have over previous researchers.

The deputy director of NMRI and chairman of the department of hyperbaric medicine and physiology, Capt. James Vorosmarti Jr. (MC), told *Navy Times* that the main problem with diving is decompression when the diver surfaces.

"If a diver goes very deep, or stays at even shallow depths for very long, the decompression period becomes so time consuming that it isn't worth doing the dive. It becomes economically ridiculous," Vorosmarti said. "You end up needing 40 divers to do two hours of work, because the divers are tied up in decompression for days," he said.

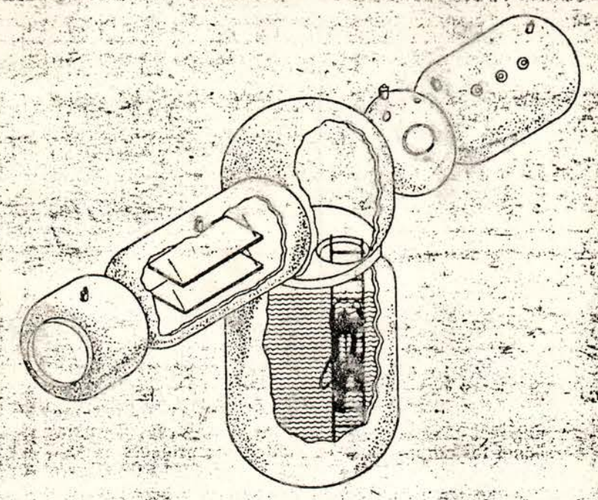
"But, if you can put someone down and they can live at that pressure, then you only have to decompress them once, and they can live in the ocean for months," the captain said. "That is our purpose here, and these chambers will enable us to do the research necessary to perfect saturation diving methods."

Several factors make it advantageous for the Navy to have the capability to dive deep and remain at great depths, said John Naquin, hyperbaric program manager. Along with research of the ocean, the Navy can conduct deep ocean salvage, exploitation of the ocean bottom and military defense.

"But besides just deep diving problems, we hope to minimize a lot of the problems associated with shallow diving — problems people have put up with for years," Naquin said.

The new $15 million laboratory with its $3.5 million man-rated chamber also includes 21 animal hyperbaric chambers. Although the chambers have been installed, they will not be ready for human tests until next year.

Two of the five chambers in the man-rated complex will be capable of extremely high pressures — 1500 pounds per square inch — and the other two, will go to 1000 per square inch, or about 2250 feet.



AN ARTIST'S conception shows how the Navy's new deep-diving test chambers, being put into operation at the Naval Medical Research Institute in Bethesda, will look. The man-rated chamber complex will enable the Navy to conduct research under dry hyperbaric conditions simulating sea depths to 3400 feet.

The large chamber complex has three separate, but connected areas where divers will live. The end sections are airlocks for moving in and out, and can be equipped with toilet and shower facilities during long "dives."

"We can pressurize the entire chamber at the same level," said Vorosmarti, "or we can pressurize one section at one pressure and the others at another."

Below the center chamber is a "wet pot" used for actual diving in water. Approximately 12 feet deep, the wet pot is also pressurized to simulate deep sea diving. Water temperature in the wet pot can be changed to simulate temperatures the diver might encounter in actual diving situations, from 34 degrees Fahrenheit to tropical temperatures.

The Navy already has the technical capability for man to dive much deeper than he has in the past, said Naquin, but medical research is lagging behind technology, and much is still to be learned about tolerance levels for pressure and depth.

"In the next 10 years we hope that many vital questions will have been researched and answered," said Vorosmarti. "The Navy has no intention of lagging behind in its research to give man new capabilities and horizons."

Navy Editor Service poster & clipsheet • November 2, 1979

Published biweekly by Navy Internal Relations Activity, Office of the Chief of Information, Washington, D. C. 20350.

# ... a breakthrough in the bends

Story by JO3 Rick Johnson

WASHINGTON (NES)... Diving experts are saying that the Navy's Pearl Harbor testing of a one-atmosphere armored diving system could bring about the greatest breakthrough in deep-sea diving to date—the elimination of air embolism (the bends).

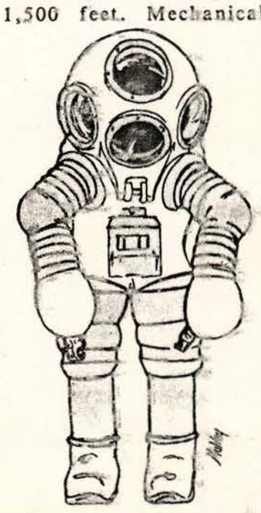
The system, encased in a 6-foot-6-inch magnesium-alloy body, is on loan from the National Naval Medical Center, Bethesda, Md., in cooperation with the British DHB Construction Company. Testing is being done by Harbor Clearance Unit One (HCU-1).

One of the divers taking part in the testing is Lieutenant Linda Hubbell, the first woman to graduate from divers school. She is a Navy Reservist on active duty with HCU-1.

Christened 'Jim,' for a man who helped design it, the system weighs between 1,100 and 1,200 pounds on the surface with an operator inside. Below the surface, depending on the bottom conditions, Jim weighs around 60 pounds.

With its hinged dome head, the system looks like something from out of this world. Four eye-like windows in the dome, two in front angling up and down and one angling off each side, enable the diver to look in almost all directions.

Jim also has movable limbs. The joints are O-ringed and circular in shape, preventing the system from freezing up even at its maximum depth of 1,500 feet. Mechanical manipulators on the arms, different types for various jobs, are flexible enough to pick up a dime.



The legs, also flexible, permit Jim to walk at a 45-degree angle, negotiate steps, and bend at the waist at an angle parallel to the ocean floor. A set of spacers just above the boots can be adjusted to accommodate divers who are anywhere from 6-feet-2-inches to 5-feet-6-inches tall.

Depending on the weight of the diver, Jim can ascend at rates of up to 100 feet per minute from the ocean floor.

Temperature controlled to protect the diver from freezing by warming and stabilizing his environment at 66 to 70 degrees, Jim once dove 905 feet into the Canadian Arctic Ocean through 16 feet of ice and 27-degree water. During this series of dives Jim broke the record for the longest working dive: five hours and 59 minutes without discomfort to the diver.

Other advantages include extended diving time (up to 27 hours with divers breathing their own recycled air), reduced biochemical problems and increased capability for repetitive dives.


If the tests made with Jim prove successful, the system could find itself diving for the Navy permanently. Meantime, the huge space-like creature seen diving to the ocean floor off Hawaii is no cause for alarm.

It's only Jim, the diver's friend.

U.S. Medicine®

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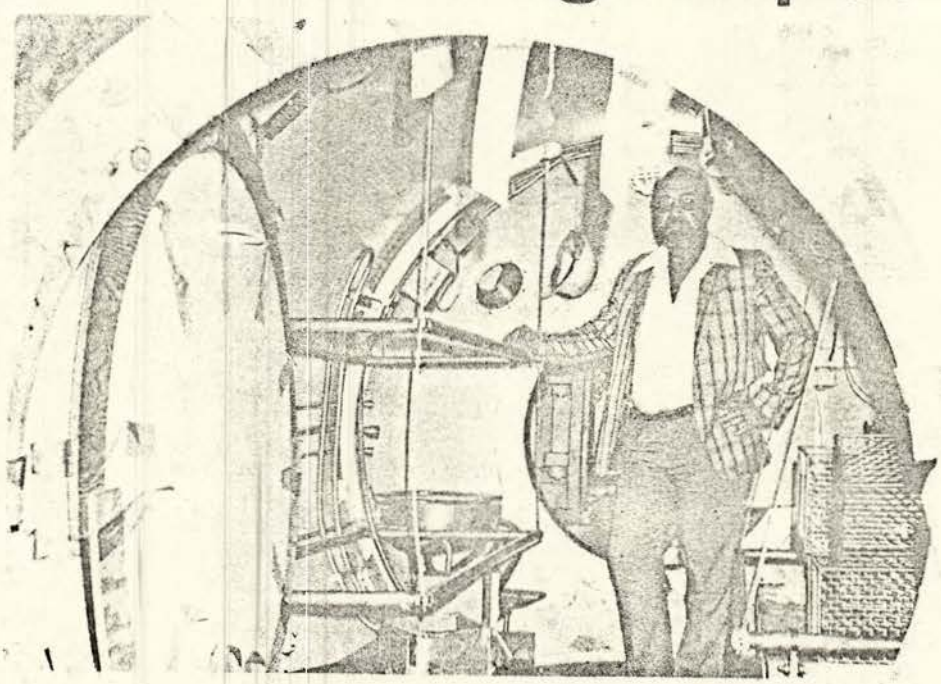
*An Independent Newspaper for Physicians*

# New Test Diving Complex



*—U.S. Medicine photo*

**John Naquin, manager of the Navy Hyperbaric Medicine Program Center, stands inside sleeping quarters of a new six-chamber experimental diving complex. Scientists fear the program's clinical potential is being overlooked. Story, page 4.**

# Deep Diving Research: Broad Potential Cited

By Suzanne Viau

BETHESDA, MD.—Biomedical research in diving being conducted at the Navy's hyperbaric research facility here has important implications for clinical medicine, its scientists say.

Yet the Navy medical department has all but ignored the potential spinoff from research conducted at the facility—research which could aid in monitoring the vital signs of critically ill patients and in the treatment of stroke, spinal cord injuries and other diseases, Capt. Mark Bradley, MC, USN, director of the Navy Hyperbaric Medicine Program Center, said in an interview.

Part of the Naval Medical Research Institute, the hyperbaric center is located on the grounds of the National Naval Medical Center.

While the center's basic mission is to support Navy diving operations, it also provides treatment and medical consultation for decompression sickness and cerebral air embolism caused by diving and altitude over-exposure.

It also aids in treatment of gas gangrene and carbon monoxide poisoning through hyperbaric oxygen therapy, Dr. Bradley said.

The center has received considerable support and funding from the chief of Naval operations and the Navy diving community, but no significant recognition or backing from the Navy medical department, Dr. Bradley said.

He added that the problem of gaining recognition is not confined to the Navy's biomedical research in diving, but to the service's whole biomedical research program as well.

"The Navy medical department is run by clinicians for clinicians. There is a general lack of understanding and appreciation for biomedical research," Dr. Bradley said.

The center also has had to compete with the Navy's nuclear submarine program for research and development funds to construct new hyperbaric research laboratories and diving chambers and has faced funding limitations and other setbacks, John Naquin, the program center's manager, told U.S. MEDICINE.

The center has an operating budget of approximately $3.2 million for fiscal 1980, although there were some cuts in exploratory funds, Dr. Bradley said.

The center currently is housed in two buildings, one of which dates back to World War II and contains several diving chambers for biomedical experimentation and treatment of decompression sickness.

The second building, which has taken 6 years to complete and is still not fully operational, houses administrative offices, a technical library, computer facilities and 12 laboratories, including one for animal toxicology.

Much of the new, two-story, 60,000-square-foot facility, however, is devoted to one of the most advanced efforts to date in diving chamber design and construction, according to Dr. Bradley. The diving chamber complex consists of five separate dry chambers and a sixth, wet diving chamber which allows for diver immersions in water temperatures of between 34 degrees Fahrenheit and 85 degrees Fahrenheit for thermal studies, Dr. Bradley said.

The six diving chambers are linked together and are designed to support a team of divers during habitation studies and other research for as long as 90 days, Dr. Bradley said.

The chamber complex includes sleeping quarters, sanitation facilities, life support systems and communication, fire protection, water conditioning, instrumentation and data acquisition systems.

There also are three atmosphere conditioning systems for the chambers and an extensive computer console in the control room outside the chamber complex with closed circuit television for viewing the activities of the divers inside the chambers.

Three of the dry chambers and the wet chamber can be pressurized to 2,250 feet below sea level, while the other two chambers can be pressurized to 3,400 feet below sea level, Dr. Bradley said.

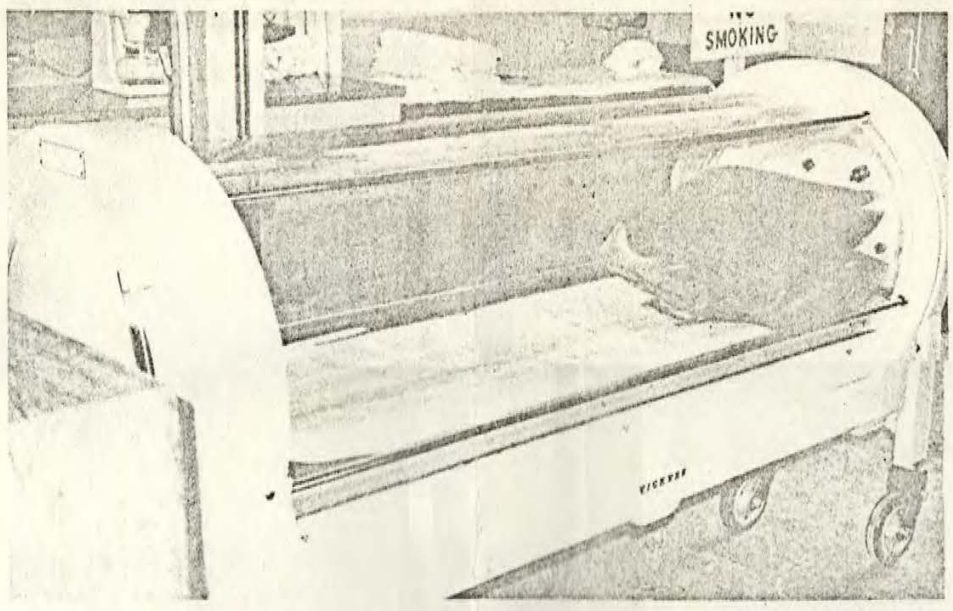
The new complex will hopefully be ready for actual testing by the end of this year, he continued.

An experienced diver, Dr. Bradley said he may participate in some of the early short-term tests of the new diving chamber complex.

The building housing the complex also includes diving chambers for animals and support areas for the diving chambers such as a gas mixing and analysis area, a helium reclamation area, a gas storage "farm" and atmospheric conditioning devices, Dr. Bradley said.

Some of these support activities, such as the procedure for reclaiming helium, (used instead of nitrogen in the oxygen gas mixtures created for divers in the diving chambers), were designed as cost saving devices, program center manager Naquin said.

Helium normally costs 15 cents per cubic foot and the center needs about 8 million cubic feet of the gas per year, Dr. Bradley said.




—U.S. Medicine photos

**Hyperbaric oxygen therapy chamber is used to treat such syndromes as ulcers or bone infections that won't heal. Patients undergo up to 40 treatments, lasting two hours a day, five days a week.**

**Dr. Mark Bradley**
*'Potential' spinoff*

Naquin said he is not sure whether the helium reclamation process actually will result in cost savings, however—it will have to be tried first.

Other efforts to reduce costs in the new complex, such as using carbon steel rather than stainless steel in some construction, has not been worthwhile, Naquin said. The carbon steel, he said, corrodes easily.

"We have the problem of living with some of the cost saving decisions made early on," Naquin said.

The new diving complex and laboratories have enabled the Navy to expand its basic biomedical research program in diving, Dr. Bradley said.

The program was reorganized last October into the four basic study areas that now exist, Dr. Bradley said.

One of the programs, under the direction of Dr. John M. Hollenbeck, MC, USN, involves examining the link between the spinal cord and decompression sickness, Dr. Bradley said. Dr. Hollenbeck has shown that in decompression sickness, bubbles appear and grow in the venous system around the spinal cord, causing an obstruction of the blood flow away from the spinal cord. This means fresh blood can't enter and the spinal cord is deprived of essential nutrients such as blood sugar and oxygen, Dr. Bradley said.

Also, when the blood flow to the spinal cord is shut off for a period of 15 minutes or more, reinitiating the blood flow to the spinal cord or the brain generally is difficult, Dr. Bradley said, because of the interaction between the blood flow and blood-damaged tissue.

Dr. Hollenbeck, however, has found that a drug combination of indomethacin, heparin and prostacyclin ($PGI_2$) enhances microvascular reperfusion when administered therapeutically, Dr. Bradley said.

Dr. Hollenbeck hopes to test this procedure in patients with stroke within the next 6 to 12 months, Dr. Bradley said.

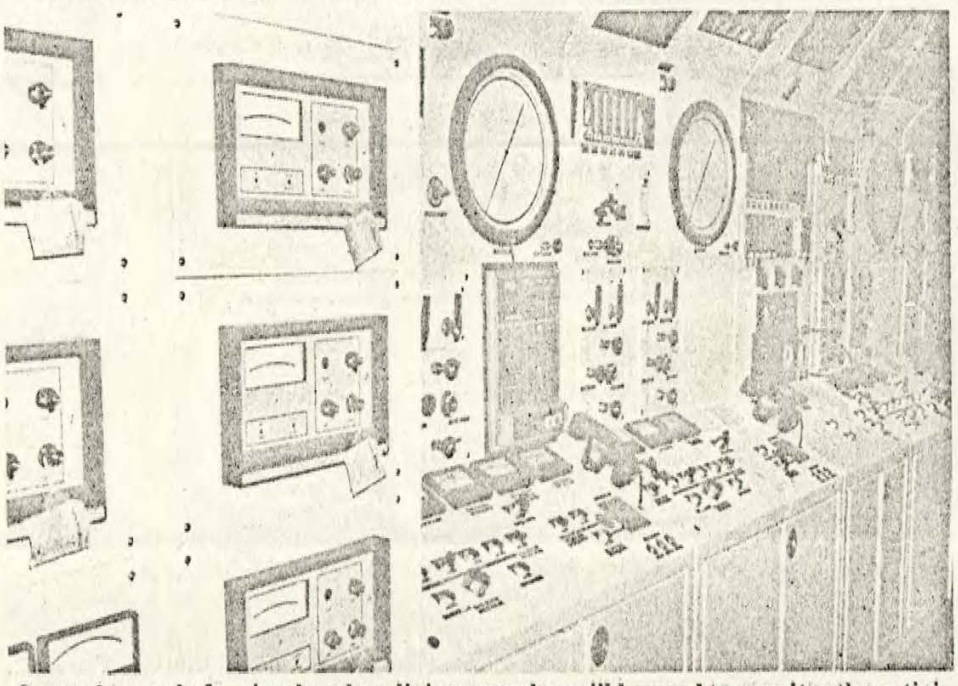
Another program under the direction of Cdr. Delbert E. Evans, MSC, USN, is examining the effects of arterial air embolisms in the cardiovascular system, Dr. Bradley said.

"Air embolisms in divers occur because their lungs become over-pressurized and rupture, causing bubbles to form and be carried to the brain," Dr. Bradley said.

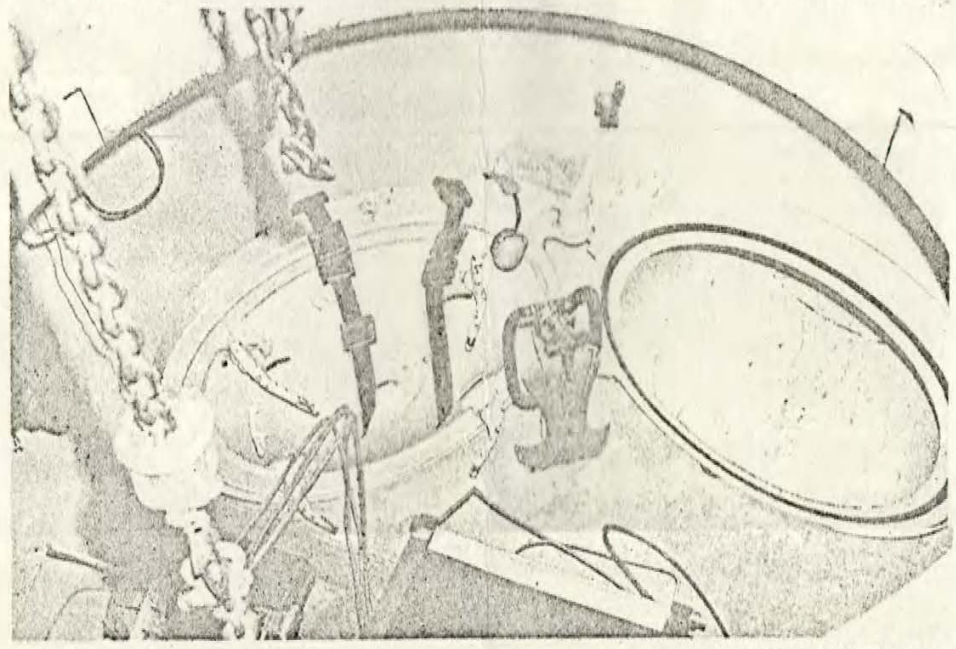
In clinical settings, gas embolisms frequently occur in a similar manner, usually when some artificial air passage into the body, such as a catheter into the heart, allows air to escape into other parts of the body, Dr. Bradley said.

After an embolism is formed, a pa-

*(Continued on page 23)*

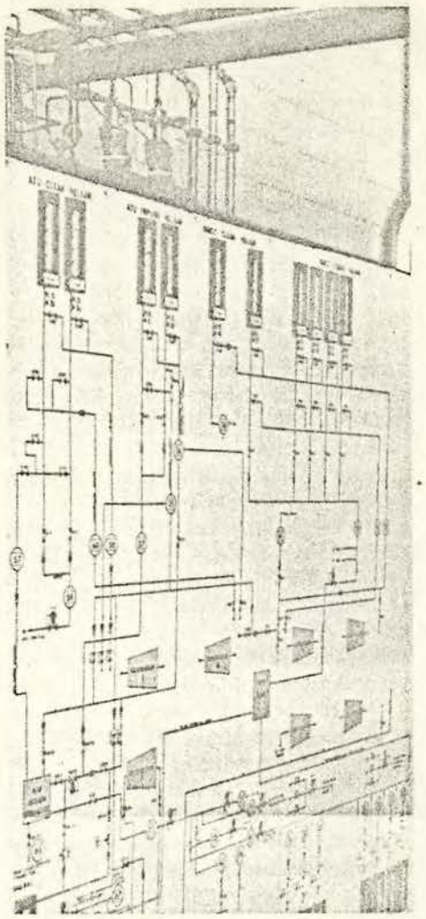


**Control console for six-chamber diving complex will be used to monitor the activities of diving teams and environmental conditions inside the chambers. The console has closed-circuit television monitors.**



—U.S. Medicine photos

**'Wet' diving chamber is part of a 37-year-old diving chamber complex still in use at the center. Diving teams could spend up to four hours immersed in this chamber for experiments.**



—U.S. Medicine photo

**Diving control board diagrams the gas supply lines for the various diving chambers.**

# Deep Diving Research: Broad Potential Cited

*(Continued from page 4)*

tient sometimes loses pulse, and recompression often is not an effective treatment, Dr. Bradley said.

"The patients also were experiencing what we thought to be disturbances of the heart rhythm that resulted from the embolisms," Dr. Bradley said.

Cdr. Evans tested in cats as animal models a procedure for infusing air by a catheter into key arteries leading to the cats' brains, which forced arrhythmias to occur in the cats' hearts. The procedure also caused an increase in the cats' blood pressure which resulted from a 100- to 200-fold increase in epinephrine and norepinephrine in the blood, Dr. Bradley said.

Cdr. Evans found the arrhythmias and blood pressure response could be eliminated by denervating certain nerves from the brain and by administering lidocaine, a local anesthetic used in the treatment of cardiac arrhythmia.

"It is possible (this procedure) may improve blood flow for tissue perfusion," Dr. Bradley said.

Dr. Bradley said gas embolisms similar to those which occur in diving settings have been treated in two open-heart surgery patients at the center. One patient had a venous gas embolism and the other had an arterial gas embolism, he said.

Dr. Bradley himself directs one program which involves measuring, through non-invasive methods, how much a diver breathes at sea level compared to various depths underwater.

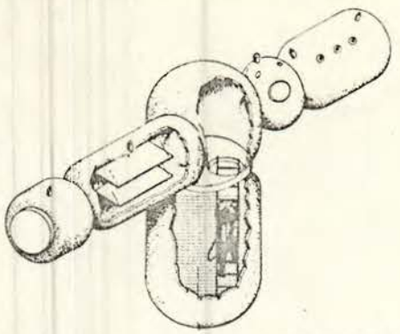
"Devices used to measure how much breath is taken at sea level can't be used under water where gas density increases and gas temperature changes affect sensitive equipment," Dr. Bradley said.

Different methods are needed to measure and examine the added load of water pressure on the respiratory system, he said.

Dr. Bradley said he has expanded upon a system for measuring changes in respiration in terms of body surface-dimensions.

Using four pairs of electromagnets and magnetometers affixed to the torso of a diver's body, Dr. Bradley developed a mathematical model and formula for determining the dimensions of the rib cage and abdominal chamber.

The model and formula yield a measurement of the volume of each breath taken by the diver. The procedure even determines how much of a contribution the rib cage makes to each breath (about 75 per cent) compared to the contributions of the abdomen (25 per cent) in a "dry" situation.



**Cutaway view of one of the diving chambers in the new laboratory complex.**

However, when the diver is immersed in water up to the neck, this ratio flip-flops and the abdominal chamber makes the larger contribution to each breath, Dr. Bradley said.

This non-invasive measurement method is "very, very accurate, within 2 to 5 per cent of the most accurate invasive means of measuring respiratory intake," Dr. Bradley said.

Perhaps the most accurate invasive method in use now is body plethysmography, Dr. Bradley said.

In time, other uses for the respiratory measurement method developed by Dr. Bradley could become the pulmonary equivalent of an electrocardiograph, Dr. Bradley said. The method also could be used for monitoring critically ill patients, for respiratory muscle training, for test and evaluation of respiratory equipment for fire fighters and coal miners and for monitoring of environmental conditions in special circumstances, such as in space capsules, Dr. Bradley said.

Another key area of biomedical study is the effects of cold in the diving environment. Thermal drain affects divers' performances and can jeopardize their safety, Dr. Bradley said.

The center is working to determine both the psychological effects of cold stress on divers and the relationship between body heat loss, water temperature and performance. This research will permit the center to develop guidelines for equipment designers in determining the heat requirements of divers, Dr. Bradley said.

The center has a subject pool of more than 50 persons and a multidisciplinary staff of over 100 physicial scientists as well as biochemists and physiologists, Dr. Bradley said.

Despite the numerous tests and deep diving experimentation conducted by the biomedical diving program there, no deaths or accidents have occurred, Dr. Bradley said.

Sea Technology December 1980

# Navy's Diving Medicine Research Complex Nears Operation

by Larry L. Booda
*Editor*

On Wisconsin Avenue in Bethesda, Maryland, a dominant feature of the skyline is the 18 story tower of the U.S. Naval Hospital. Formerly devoted to wards of the hospital, it now contains laboratories and offices, while the patients have been moved to a new, more easily evacuated facility next door. Across Wisconsin Avenue are the multiple laboratory buildings of the National Institutes of Health.

Not readily seen to the rear of the hospital is a huge complex of relatively new buildings that comprise the Naval medical Research Institute (NMRI) and the Defense-wide Uniformed Services University of the Health Sciences.

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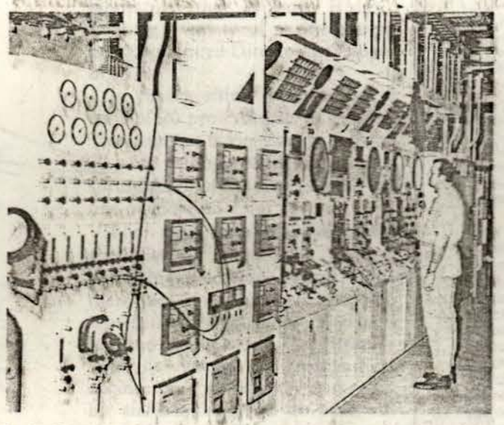

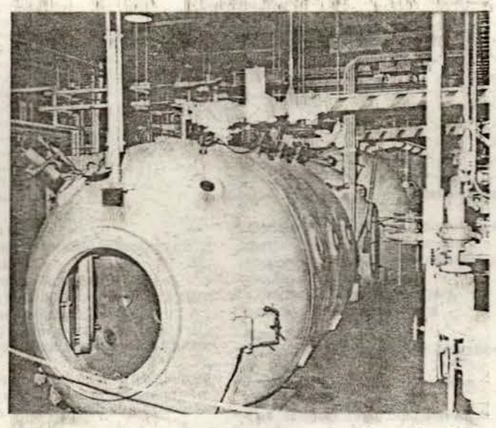

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Sea Technology December 1980

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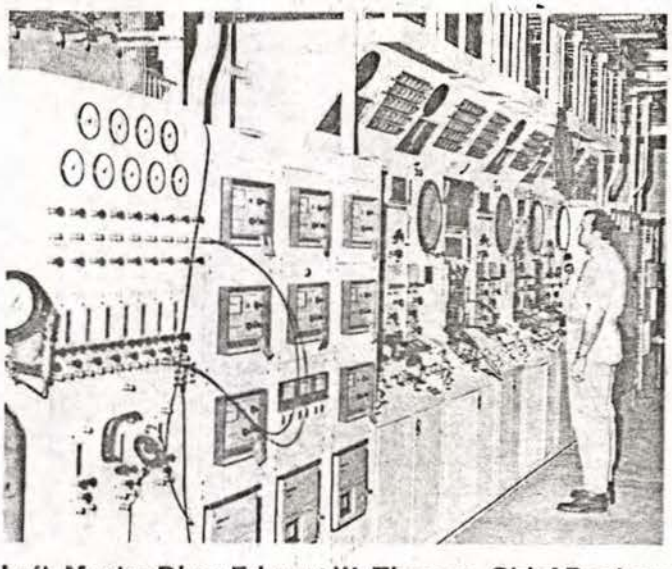

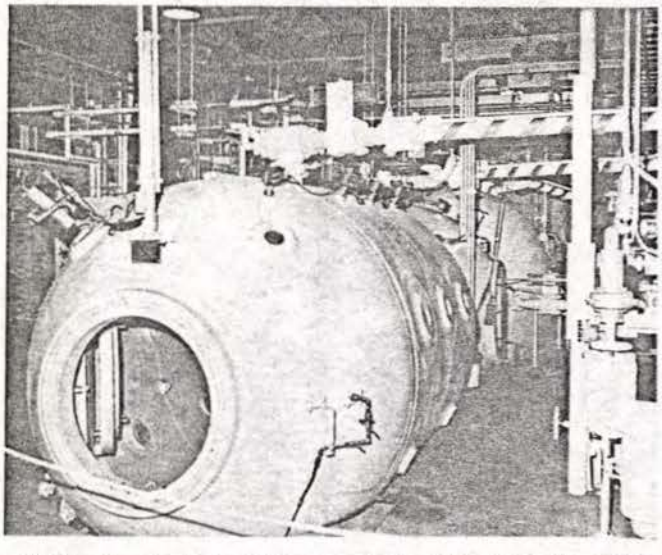

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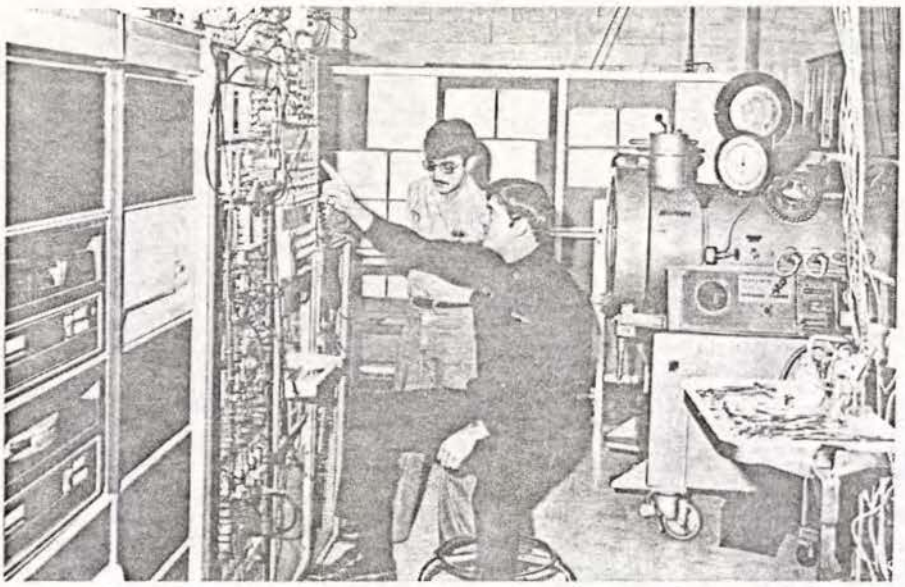

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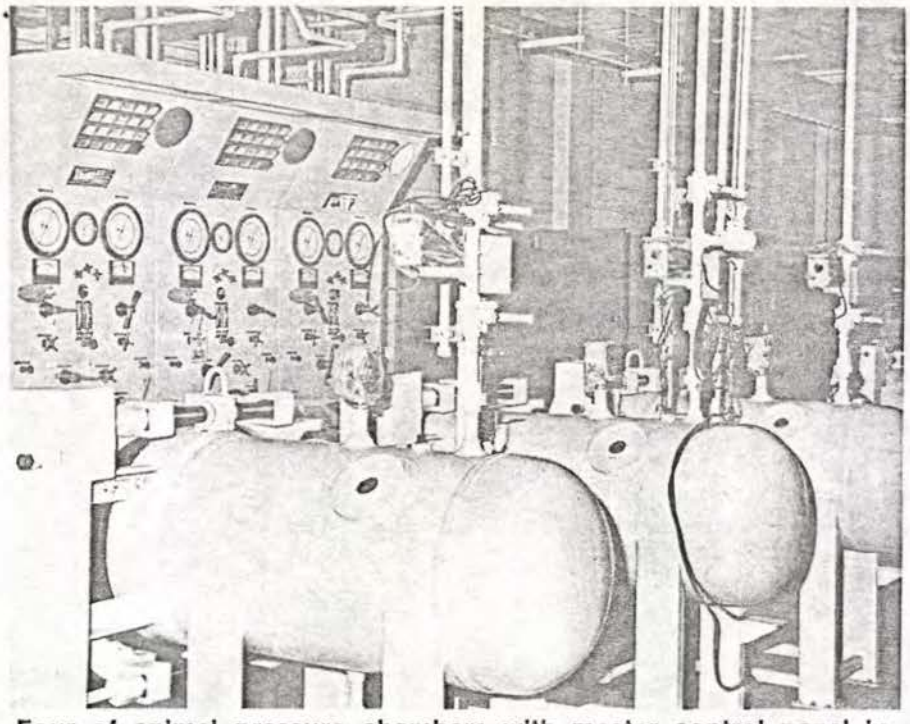

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## Navy Diving

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There are double chamber doors between all dry chambers to allow for any operating chamber combination at lesser or greater pressures than adjoining chambers. The heads are claimed to be foolproof. They can not be operated while being sat on.

Because the chambers strain during compression the chamber assembly is supported by cushioned saddles on either side of the central chamber. This arrangement provides for stress relaxation.

During chamber fabrication and pressure piping installation considerable attention was given to quality assurance. When this writer visited the installation recently unmanned tests were underway.

On the animal side the installation has some distance to go before operations begin. A movable chamber that runs on tracks that are as yet nonexistent to service the three banks of chambers has yet to be installed, although it is on hand in a crate.

The MRCC breathing gases can be supplied by three modes. One is by periodic venting to supply fresh gas. Another is by conditioning the gas and recirculating it. The third is through a mask or built-in breathing system(BIBS). For shallow air dives pressurization and periodic venting to remove the carbon dioxide and replenish the oxygen is available through local panels in each chamber. In most operations, however, the breathing gas will be recirculated through one or more of the three atmospheric conditioning systems. Sodasorb is the principal substance used to scrub carbon dioxide from the mixtures. The sodasorb system is redundant, so that a canister can be cleaned and recharged without shutting down.

Three voice systems and closed circuit television provide communications. Primary communications are provided by the open intercom with a speaker-mirophone in each chamber when voice unscrambling is not needed. The helium voice unscrambler was manufactured by Divers Unlimited.

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# SEA TECHNOLOGY

SINGLE ISSUE

Marine Electronics • Instrumentation • Systems Design • Marine Pollution • Ocean Research • Diving
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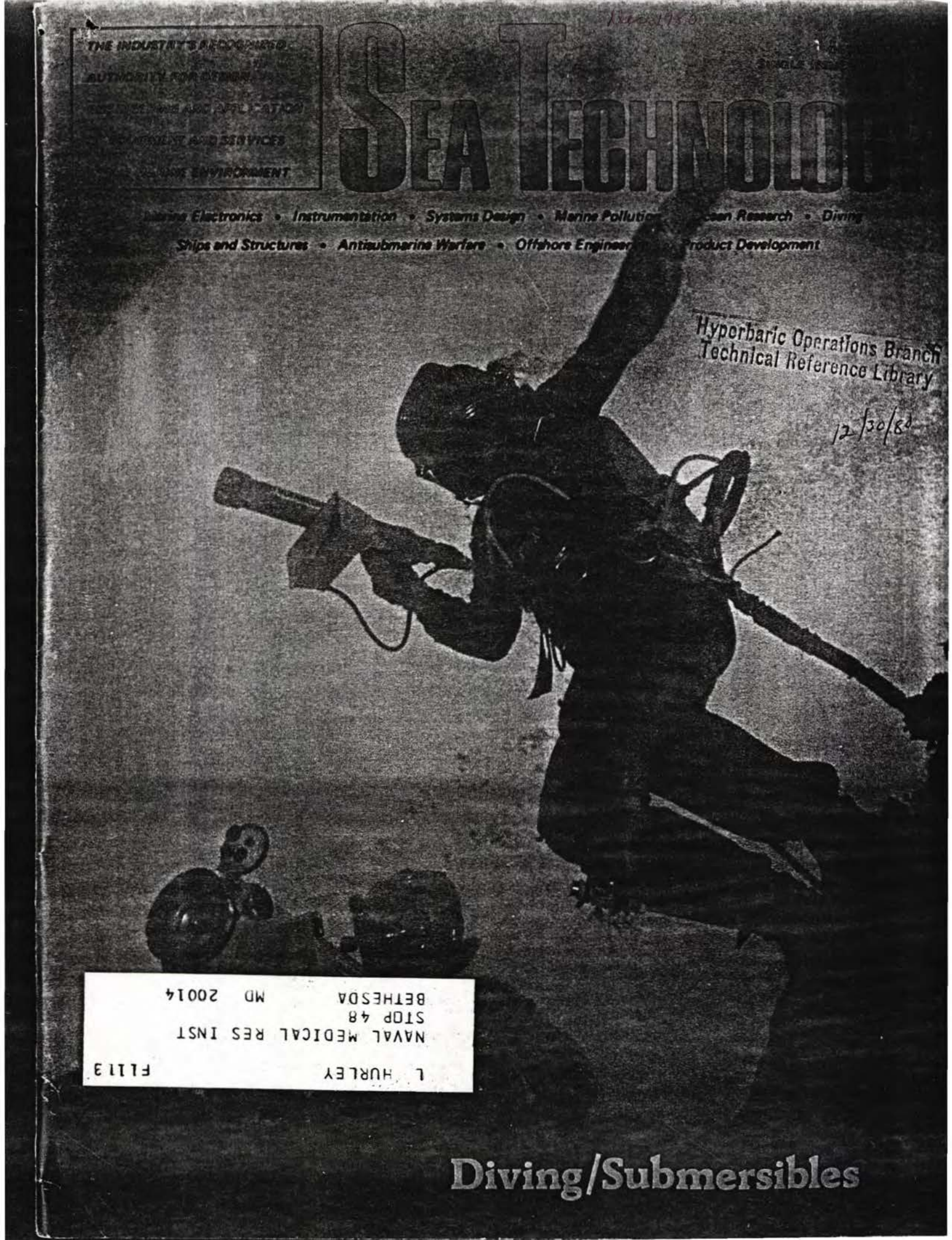





## Diving/Submersibles

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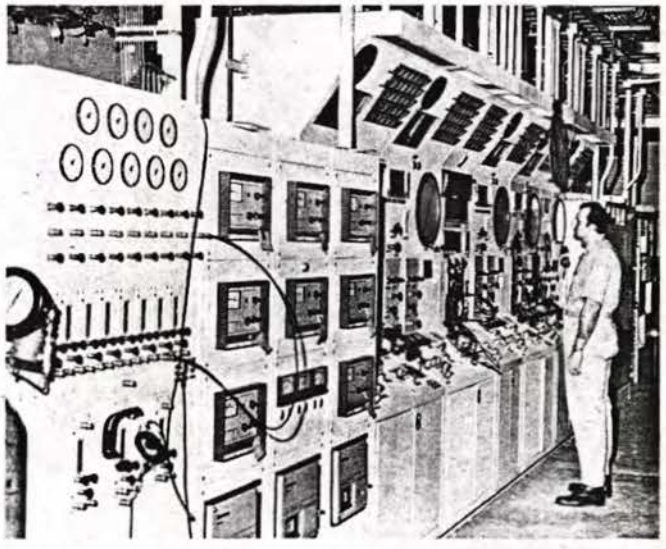

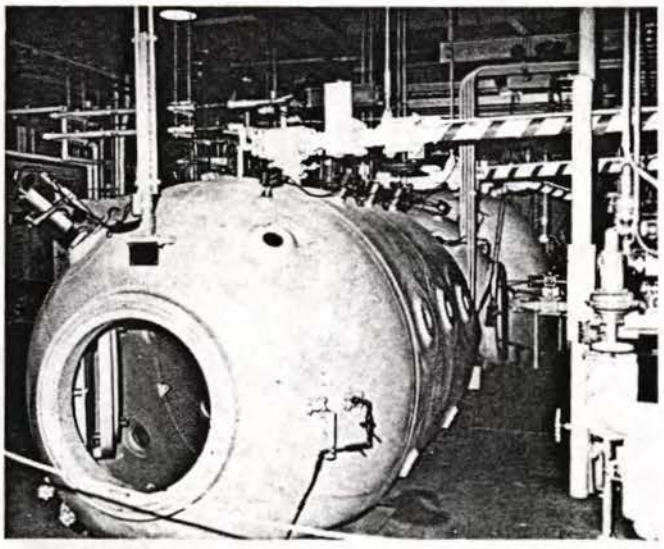

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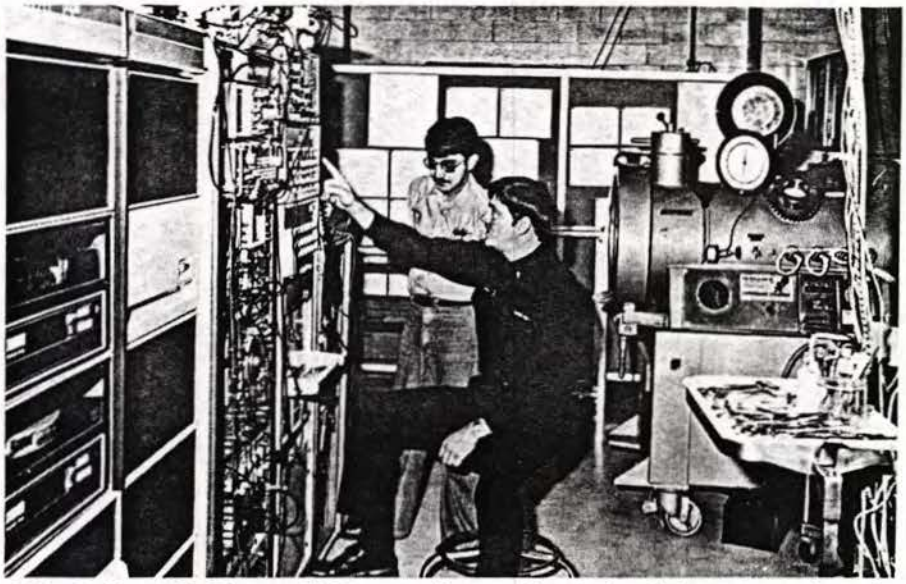

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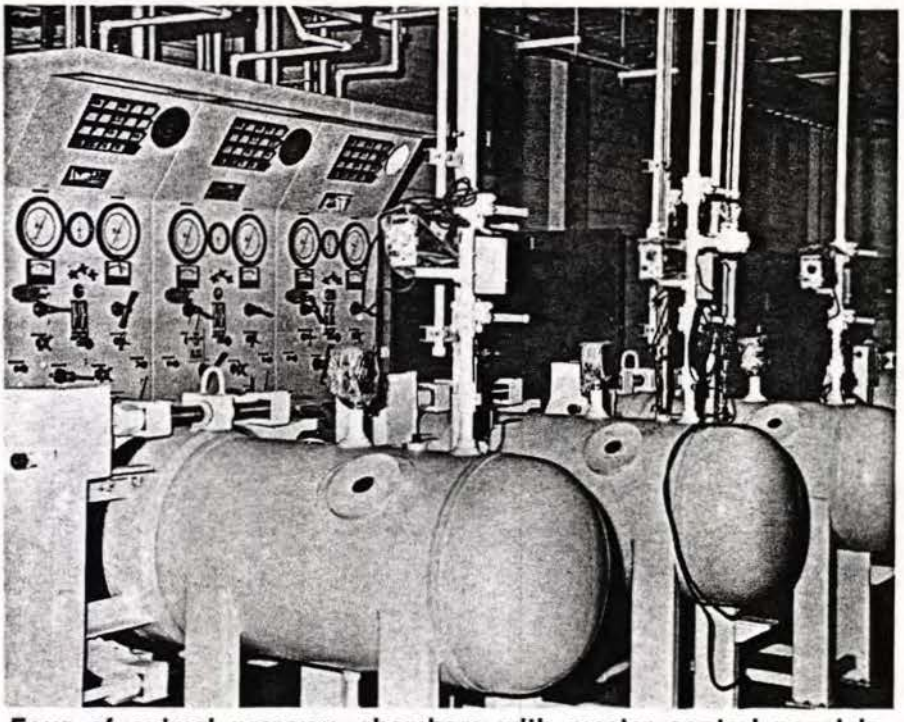

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The chambers in both the MRCC and animal rooms are fabricated of HY-80 steel to American Society of Mechanical Engineers Section III criteria for Class 1 pressure vessels.

Each chamber has a service lock, viewports, lighting penetrations—acrylic tubes, not wiring—piping penetrations and facility and experimental instrumentation penetrations. The two MRCC 1500 chambers are welded together as are the three dry MRCC 1000 chambers. Bolted double O-ring joints connect the MRCC 1500 and the MRCC 1000, and the wet chamber to the diving chamber of the MRCC 1000.

There are double chamber doors between all dry chambers to allow for any operating chamber combination at lesser or greater pressures than adjoining chambers. The heads are claimed to be foolproof. They can not be operated while being sat on.

Because the chambers strain during compression the chamber assembly is supported by cushioned saddles on either side of the central chamber. This arrangement provides for stress relaxation.

During chamber fabrication and pressure piping installation considerable attention was given to quality assurance. When this writer visited the installation recently unmanned tests were underway.

On the animal side the installation has some distance to go before operations begin. A movable chamber that runs on tracks that are as yet nonexistent to service the three banks of chambers has yet to be installed, although it is on hand in a crate.

The MRCC breathing gases can be supplied by three modes. One is by periodic venting to supply fresh gas. Another is by conditioning the gas and recirculating it. The third is through a mask or built-in breathing system(BIBS). For shallow air dives pressurization and periodic venting to remove the carbon dioxide and replenish the oxygen is available through local panels in each chamber. In most operations, however, the breathing gas will be recirculated through one or more of the three atmospheric conditioning systems. Sodasorb is the principal substance used to scrub carbon dioxide from the mixtures. The sodasorb system is redundant, so that a canister can be cleaned and recharged without shutting down.

Three voice systems and closed circuit television provide communications. Primary communications are provided by the open intercom with a speaker-mirophone in each chamber when voice unscrambling is not needed. The helium voice unscrambler was manufactured by Divers Unlimited.

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# OMIR

## OFFSHORE MAINTENANCE INSPECTION & REPAIR

The only publication exclusively serving the offshore maintenance, inspection, repair and associated industries.

No. 7 — Week ending March 27, 1981




OMIR

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# OMIR OPPORTUNITIES

**Continued from page 3**

Naval Base and one floating docks capacity 4,500 tonnes at Mers El Kebir Naval Base are required by the Algerian Navy.

Documents from: Base navale D'Alger-(Ex Amiaute) Alger (Sous Direction des Finances) Alger (Algerie).

Tenders in French from manufacturers in double sealed registered envelopes with outer marked "A.O. No 11-81-MDN-DMN-SDF-Pour La Fourniture Et L'Installation De Pilotis Pour Un Docks Flottant A la Base Navale D'ALGER Et A La Base Navale De Mers El Kebir."

***Respond to: Ministere de la Defence Nationale – DASC (Soumission), Boite postale No 298 Alger-Gare (Algerie).***

## INDIA

MAZAGON Dock Ltd (Offshore Project Division) in Bombay are to buy a secondhand tanker/bulk carrier which they will convert to a derrick/pipe lay barge for the transportation and installation of offshore platforms.

Modification of the carrier will involve the fixing of a derrick crane with a fixed mode capacity of 700M.T. and a 500/550 M.T. capacity in revolving mode.

***More information: General manager, Offshore Project, Mazagon Dock Ltd., Dockyard Road, Bombay 400 010, India.***

## EGYPT

OFFSHORE platforms; sea lines; process equipment for natural gas; fire protection and fighting systems; pumps; living quarters and helideck; mechanical and electric installation of equipment (off and onshore); electric power transmission systems; and electric power generation – all these are required for the second phase of the Abu Qir development project.

Documents can be obtained against payment of one hundred Egyptian pounds from the Egyptian General Petroleum Corporation, WEPCO, after March 30th with the closing date at April 30th. Local representation is essential.

***More information: WEPCO, Attention Technical Services Manager, PO Box 412 Alexandria. Telex 54075 WEPCO UN. Egypt.***

## ALGERIA

TENDERS are required for an offshore survey of marine sea bed involving geophysical tests, mechanical on-site drilling, sample taking and laboratory tests. Work is to be done at right angles to the water inlet for the 680mw thermal electric power station to be built at Ras Djinet 80km east of Algiers, to start this summer and finished by September 30th 1981. Closing date for tenders is April 25th 1981.

***More information: SONELGAZ, Direction de L'Engineering, Service Engineering des Moyens de Production, 2BD Salah Bonakoir Alger. Telex 52657.***

## DENMARK

BIDS are opening in April for work on a single anchor leg mooring (SALM) arrangement at Understed, Frederikshaven in Northern Jutland, Denmark.

Work covers removal of existing underwater mooring facilities, burial in seabed at 2m depth of existing 14-inch pipeline 4 x 4,000m long, supply, installation and burial of a new 14-inch underwater pipeline, 2 x 1500m long; defining, manufacturing supply and installation of SALM type mooring facilities. The SALM includes a patented swivel system.

This project is a turnkey job and the successful bidder will be the main contractor for implementation of the entire project.

Firms interested should obtain a certificate of eligibility and express their desire to tender before April 3, 1981, via their Embassies/consultates to ***Danish Defence Construction Service, Pol Administration, Gadholtvej 11, DK-9900 Frederikshaven, Denmark.***

## INDIA

WORLD Bank assistance is being considered for development of South Bassein offshore gas field in India. Project preparation is now underway.




**OMIR is published weekly by *Offshore Maintenance, Inspection and Repair Publications*, Grosvenor Gardens House, 35/37 Grosvenor Gardens, London SW1W 0BY. Telephone: 01-828 6626. Telex: 894354 (TRANST-G). Editor and Publishing Director: Roger Tillèray. Publisher: Jack Stockdale. Typesetting by Gee Graphics Ltd, 15-27 Gee Street, London EC1 and Printed by Printfayre, 211-213 Merton Road, London, SW18.**




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# OMIR

**OFFSHORE MAINTENANCE INSPECTION & REPAIR**

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No. 7 Week ending March 27, 1981


## Big new sales for the one-man Mantis

AFTER only two years on the market, the Great Yarmouth, UK, designed and manufactured Mantis – a one-man tethered atmospheric submersible for rig support work, platform inspection and salvage operations – is achieving extraordinary success. In the last few weeks its makers, the OSEL Group, have sold three units to add to the eight already in the field and are now running a batch of eight to be completed on option by the end of June this year.

The basic Mantis unit costs about £195,000 but with handling equipment and extras can run to £220,000.

One of the three units sold recently was bought off the OSEL stand at the International Diving Symposium in New Orleans and brought back to Great Yarmouth for a refit before delivery, one has been sold in the UK and the other to a Norwegian company.

Asked the reason for the recent accelerated success of Mantis, an OSEL spokesman told *OMIR*: 'Of course, we believe it is an excellent system. And now that it has become accepted and tried, apparently everyone is interested. The biggest advantages of Mantis are that it is self-contained and has its own life support system. And against RCV systems, it has the obvious advantage that it has a man with a brain down there who can assess a situation very quickly and react accordingly.'

Even so, OSEL recognise the future role of sophisticated unmanned units and have developed an RCV version of Mantis that is due to start trials in May.

OSEL also manufacture WASP, another manned submersible which travels at 25° forward to the vertical with the operator in a standing position.

Although OSEL has 120 employees in Great Yarmouth, their success with Mantis has been such that about 90 per cent of all its work now overspills into two or three other companies in the area. 'This means that we can still give most of our time to research and development, which is so vital in an industry of such sophisticated technology.'

He foresaw the only real competition for Mantis coming from Canada where a similar unit called Wrangler is now being marketed.

OSEL promotion on Mantis has this to say: 'The single most important feature of Mantis apart from its flexibility is its safety. The life support system is self-contained. The pilot in Mantis has emergency power provided by on-board batteries, through-water communications and can jettison the umbilical cord and non-essential equipment enabling him to make a free ascent.

"In addition, Mantis is particularly cost-effective when compared with saturation diving. The need for expensive gas mixes is eliminated since the pilot breathes ordinary air at one atmosphere (The life support system is of the

● **Continued overleaf**

***Mantis – safety factor***

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oxygen make, carbon dioxide scrubbed type).

'An operating crew of four or five is all that is required.

"The Mantis may be fitted with additional systems and tooling: for example, sonar, NDT instruments, video, wire brushes and hydraulic cutters.

'Electrical power for all services is drawn from the surface power supply unit via the single tether cable which also provides hard line communications and video channels and doubles as the lifting cable.

'Not only is the submersible small and compact but so is the handling system which we supply. A launch arm or frame, a power-pack and a winch with control station are all that is required together with a simple operator's cabin.

'Mantis has been designed so that any repair or maintenance can be carried out with ease. Working parts and power supplies are in modular form and therefore easily accessible.'

***More information: OSEL Group, Boundary Road, Harfrey's Industrial Estate, Great Yarmouth, Norfolk NR31 0LU, England.***

## Eight hundred oil names

THE new Grampian Directory compiled by the North East Scotland Development Authority (NESDA) was published on Wednesday of this week.

It lists companies in the Grampian Region in three sections – (a) companies involved in oil as a principal activity, (b) companies involved in oil as a partial activity and (c) manufacturing and processing companies.

The companies are listed with their address, telephone and telex numbers and a brief description of their activities. In the first two sections of oil-related companies, a contact name is also given in most instances.

Around 800 companies are listed in the first two sections and more than 700 are listed in the third section.

In addition to these listings and their associated indexes, the directory includes information on the offshore and traditional industries of the Grampian Region with a number of maps and photographs.

Available from: ***NESDA offices in Aberdeen, Elgin or Peterhead and main newsagents in the Grampian Region price £1, or by post, price £1.25 from NESDA, 57 Queens Road, Aberdeen AB1 6YP.***

## New rules for UK semi-subs

UNITED Kingdom-registered semi-submersible rigs in British waters – there are currently seven out of 24 – will be subject to new safety equipment inspection regulations if rules now being drafted by the British Board of Trade under the Merchant Shipping Acts are passed by Parliament.

The new regulations will require certification of rig safety equipment by Board of Trade surveyors annually instead of once every two years as at present. The equipment concerned ranges from fire-fighting to communications to life-saving equipment.

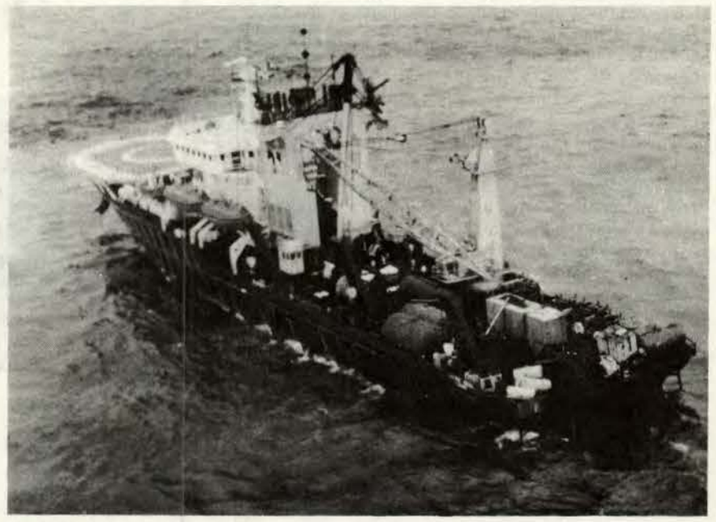
## Major support contract for Thalassa

WHAT IS described as one of this season's major North Sea diving support vessel contracts has been won by Thalassa Offshore (Scotland) Ltd. from Shell U.K. Exploration and Production. It calls for the provision of subsea construction, inspection, maintenance and repair services on numerous oil and gas-related facilities, submarine pipelines and manifolds in the Brent and Auk fields.

The contract started on March 1 and will run for a minimum of six and a maximum of 10 months.

The vessel from which Thalassa are conducting the operation is the advanced d.p. diving support vessel the mv *Arctic Seal*, which is owned by Bergship and which has been secured by exclusive arrangement with the ship owner. Thalassa are providing diver and engineering technicians, as well as the onshore support, and Bergship are providing the marine crew.

*Arctic Seal*, a highly advanced monohull multi-purpose vessel, was the leading support vessel at the Ixtoc blowout in the Gulf of Mexico and is equipped to perform a wide range of functions such as subsea inspection, construction, hyperbaric welding, on-board fabrication, saturation diving, spool piece handling, fire fighting, rescue work and pollution control.



***The mv Arctic Seal***

Thalassa have been performing similar work for Shell in the Brent and Auk fields since 1976 on a continuous long-term basis from their d.p. diving vessel, the mv *Capalonga*, which is now on charter in the Mediterranean.

## S. Africa steps up oil search

SOUTH Africa's offshore oil exploration programme will be stepped up with two new deepsea rigs to be built in Japan at a cost of $207m (£94m) for delivery late next year or early 1981. They will be capable of operating in severe sea conditions at depths of below 500 metres.

The rigs have been ordered by Sokeer, the South African state-owned exploration company.

**OMIR correspondent in Durban**





## Fifty divers at Bethesda

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He also revealed that construction was now complete on the hyperbaric chamber complex and that it was now in the final stages of testing. 'It will be operational by early summer.'

He said the complex would enable simulated deep diving to be carried out by six people for up to 90 days at 3,400 ft. 'We have no plans to encapsulate people for this length of time at the moment but the facility is there.'

## Polaris for four platforms

A NEW work vessel is due to arrive in Australia in the next few weeks to begin offshore installation of Esso-BHP's West Kingfish production platform in the Bass Strait, Australia's major oilfield.

The vessel, Raymond Offshore Construction S combination derrick-pipelay barge *Polaris*, is coming to Australian waters from the Gulf of Mexico.

It is a new generation of barge, launched in November 1979, and has a crane lift capacity of more than 1200 tonnes.

Esso BHP has chosen the vessel to install its next four platforms – West Kingfish, Fortescue, Cobia and Flounder – in the Bass Strait because of its greater hook load capacity. The four platforms are larger and heavier than any of the previous platforms installed by the partners and need the greater lift capacity of the *Polaris*.

Installation of the four new platforms is part of a 12000 million Aust dollars exploration and development programme in the Bass Strait by Esso-BHP over the next four years. Of this 240 million Aust dollars is being spent on new field development and construction of new platforms.

The aim is to maintain current oil production at the rate of about 400,000 barrels a day (about 93 per cent of Australia's total domestic oil production) and increase natural gas production to meet the rising demand from the market in the State of Victoria. Bass Strait produces about two thirds of Australia's daily consumption of crude oil.

The *Polaris* will begin installation of the West Kingfish Platform in April. The steel structure has been lying complete on the slipway at Sale in Victoria for the past three months awaiting the arrival of the vessel.

The schedule is for the jacket to be skidded on to the launch barge and seafastened in early April. *Polaris* should arrive at the same time as the seafastening operation is being carried out, but some time will be spent in rigging the derrick barge for the lift programme before both it and the jacket move out to the West Kingfish Field.

On the slipway at Sale the Cobia jacket will move to front position, allowing the Fortescue platform to be erected behind it.

Previously Esso BHP have used a smaller work vessel, the J. Ray McDermott Barge DB21, for the installation of its previous Mackerel, Tuna and Snapper jackets. But it does not have the same load capacity as the *Polaris*.

This vessel is at present in South East Asia working in Indonesian waters. This work will be completed by mid-year and then the derrick barge will undergo a three-month four million Aust dollars upgrading of its lift capacity in a Singapore shipyard.

The work will increase the crane lift capacity by 30 per cent to more than 1000 tonnes – a change that will put the barge into the new-generation category.

## Concrete sonic pulse echo

TO determine thickness of a concrete member, depth of fractures or voids, and length of long thin concrete pilings under water where only one surface is visable, a non-destructive system is required. Pulse echo systems using seismic and ultrasonic devices which have been used previously for soil and metal were not found suitable for concrete.

Investigations have now been made into the feasibility of a sonic pulse echo technique which introduces a longitudinal pulse into the concrete at a surface by mechanical impact (eg. instrumental hammer), and measures the echo time using the time base of an oscilloscope, at the U.S. Army Engineer Waterways Experiment Station.

Measurement of thin slab was found difficult, but detection of cracks and flaws designed into three drilled piers was demonstrated by the Army's pulse echo system.

# OMIR OPPORTUNITIES

### INDIA

VARIOUS high pressure hoses are required for the Bombay Offshore Project of the Indian Oil and Gas Commission. Tenders, which close on April 16, include the supply of:

- Thirty 1″ 6000psi test pressure chikson high pressure complete hose in standard section of 12ft incorporating two standard series style 50 swivel joint, including 1″ WECO 602 wing unions on ends
- Ten repair kits for 1″ 6000 psi test pressure chickson hose
- Ten chickson high pressure swivel joints style 50 for maximum working pressure up to 6000 psi
- Twenty complete WECO union size 1″ fig 602 test pressure 6000 psi having standard acme threads on female subs with sealing (male and female) LP threaded.
- Eighty 1″ 6000 psi test pressure steel chickson hose straight section of 5ft or 6ft long, with 1″ weld Fig. 602, 6000 psi test pressure male connection on one end and female connection on the other.

***More information: Additional director (Stores and Purchases), Oil and Natural Gas Commission, 15-E Maker Towers, Cuffe Parade, Colaba, Bombay 400 005.***

### USA

PRODUCT Development Associates, an American technology development and marketing company, are looking for manufacturers to make under licence the 'Jacobson' Extendable Boom Crane, for which they hold exclusive marketing and licensing rights.

The Jacobson crane is claimed to have unique operating capabilities. Its 20ft boom nests entirely within its housing and can be fully extended or retracted under loads of up to 6500 lbs.

The crane is operated by a 3-level hydraulic control system, is self-elevating to work over obstructions, rotates 360 degrees under load and can be mounted on a wide variety of carriers.

***More information: Mr. Donald Benson, Product Development Associates, 434E 7th Street, Port Angeles, Washington 98362, USA.***

### ALGIERS

TENDERS for the supply and installation of pilings for a floating docks, capacity of 2,500 tonnes at Algiers

● *continued overleaf*

# OMIR OPPORTUNITIES

## BRAZIL

LONG-TERM co-operation is sought by Themag Engerharia (Brazil), possibly in the order of ten years, for offshore oil work. This would include offshore platform design, prospecting work of various types covering geological, geophysical, and data processing, as well as resevoir engineering, and secondary and territary recovery.

***More information from: Sr. Luis Ferreira Vas, Themag Engharia, Rue Bela Cintra 986, 01415-Sao Paulo, Brazil.***

## ALGERIA

SUPPLY of 30,000 litres of pipeline corrosion inhibitor (Bactiram 471) is required by the Algerian State Gas and Electricity Organisation (SONELGAZ) for the cathodic protection of natural gas piping.

***Documents from SONELGAZ, Direction de l'Engineering-Service Engineering Gaz, 7, Chemin Farnane Hanafi Hamma, Algeria. Tenders in French from manufacturers only, in double sealed envelopes, the outer anonymous envelope clearly marked 'A.O. No 001 – KDG – 81 – a ne pas ouvrir'. Tender number: 001-KDG-81. Closing date 6/4/81.***

## SIERRA LEONE

AFTER promising seismic surveys, Mobil is to undertake a sea bottom survey off Turner's Peninsula, Sherbro Island, Sierra Leone, prior to setting up a drilling rig – now being prepared in Texas – in late May or early June.

Mobil's newly-formed Sierra Leone Oil Exploration Company is now studying future dock and communications requirements.

***More information from: Mr. Alfred Amoah, Mobil Terminal, Kissy Dockyard (by S L Oil Refinery), Kissy, Freetown, Sierra Leone.***

## THAILAND

A LOAN of $53 million (£23 million) by the Asian Development Bank to the Petroleum Authority of Thailand is proposed for a big natural gas transmission and distribution project. A fact-finding mission by bank officials has been suggested for next month (April).

The project involves construction of a 24″ diameter, 43 km long submarine pipeline from the Kaphong Platong gas field to the main pipeline from the Erawan gas field to Rayong; the installation of three 4,000 h.p. onshore compressors at Rayong; and construction and distribution pipelines totalling 43 km. to serve various industrial areas.

***More information from: Petroleum Authority of Thailand, Vibhavadi, Rangsit Road, Bangkok 9, Thailand.***

## CANADA

THE 79 km underwater natural gas pipeline to be built for the British Columbia Government, from the mainland to Vancouver Island, by BC Hydro – a provincially-owned power authority – is expected to start deliveries in about two years' time. Interested equipment and service suppliers should contact:

***Mr. Charles A. Park, P. Eng., Supervisor, Pipeline Design Gas Engineering Division, BC Hydro, 3777 Lougheed Highway, Burnaby, BC V5C 3Y3, British Columbia, Canada.***




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# OMIR

## OFFSHORE MAINTENANCE INSPECTION & REPAIR

**The only publication exclusively serving the offshore maintenance, inspection, repair and associated industries.**

No. 6

Week ending March 20 1981


## World's most sophisticated diving medicine establishment

THE most sophisticated diving medicine establishment in the world will be completed in Bethesda, Maryland, in the next few weeks to provide the industry with the latest research into medical, physiological and technical aspects of high-pressure operations on divers.

The US Navy Medical Research Institution High Pressure Medicine Establishment, which has taken more than 10 years to plan and construct, includes a man-rated chamber complex, gas supply department, laboratories and computers.

Four main areas of research will be undertaken by the centre – bioengineering, medicine, physiology and hyperbaric operations. The director of the establishment is Captain Mark Bradley, a specialist in pulmonary physiology. He will have a staff of 30 specialists and researchers.

Dr. Bradley is himself carrying out a research programme into the effect on respiratory muscles during diving including the work load of a diver under high pressure in deep water.

A monitoring system has been developed to record a diver's breathing which is similar to an electrocardiograph. Four disc magnetometers, about 1″ in diameter will be mounted on the back and front of the diver's rib cage. Results will be electronically calibrated.

In the respiratory field research is also being undertaken on controlling respiration; the effect of lungs in decompression situations, and breathing gas temperatures during operational diving.

The man-rated chamber complex will simulate decompression situations – three dry and one wet chamber will be capable of simulated pressurisation equivalent to a depth of 685 metres and a further two dry chambers to 1,036 metres.

This complex will enable researchers to work on a programme which will include the effect of temperature, exercise and oxygen toxicity during and after decompression.

The effect of drugs in post decompression situations will form an important study at the US Navy Medical Research Institution under Captain John Hallenbeck.

Air in the brain often leads to heartbeat irregularities and can cause fibrillation. Dr. Hallenbeck is researching drug treatment in this field.

Although there is worldwide research into overcoming cold and hypothermia on divers the Bethesda centre is also undertaking a programme in this field to determine the biological changes and the ultimate degrees of cold a diver can take.

OMIR correspondent in Houston

## Shot-blasting, painting needed

SHOT-blasting and painting services will be required for the refurbishment of steel piers and cross braces on four jetties at the Mobil refinery in Coryton, Essex, England, where about half the 175,000b/d production is from North Sea oil.

One of the jetties is 200 yards long; the other three are 50 yards long.

Work will start this year in a 12-month programme spread over two years in the summer period.

***More information from: Mobil Oil Co., Coryton Refinery, Coryton, Essex.***

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## Saudis back cannon to fight oil fires

THE Saudi Arabian Government has signed a contract with an Australian research team to develop a supersonic water cannon to extinguish offshore and onshore oilwell fires.

The Saudi Government has been so impressed by the technique, being developed in the University of Sydney's Department of Mechanical Engineering, that it has agreed to finance the project to more than a million Aust dollars over the next six years.

The aim is to develop a much safer and quicker method of extinguishing oilwell fires, which at the moment are costing the Saudis hundreds of millions of dollars.

The research team, led by Dr Roy Henderson, has developed a high speed water cannon which will fire jets of liquids at supersonic speeds. The team now plans to refine the technique to produce jets speeds greater than the momentum of oil spewing from the wells on fire, so dousing the blaze.

This technique would replace the most commonly-used method of putting out oilwell fires: a blast of high explosives which flows away the fuel.

Dr Henderson believes the project could introduce the first major developments in oilwell fire-fighting methods since 1950 and says that as far as he knows no new technology in the area has been developed anywhere in the world, although refinements have been made to existing methods.

The Saudi Government will give the University 390,000 dollars Aust for the first year of research and 90,000 dollars Aust every six months for the remainder of the project which is expected to take about six years.

The researchers have developed the water cannon from parts of four 17-pounder anti-tank World War Two


● **Continued overleaf**

guns. Later a more elaborate field gun will be made for wider tests to be carried out in isolated areas, such as rifle ranges, before a production prototype is developed.

The team will also work on the development of other methods of oil-well control, such as a special surface control capping device.

In April, Dr Henderson will visit Saudi Arabia to collect data on features like surface and bottom hole pressures of oil wells, their diameters and the nature of the fluids in them. This will enable him to define the oilwell fire problem so that research and development of the equipment can proceed.

While in Saudi Arabia, Dr Henderson will liaise with researchers at the King Abdul Aziz University.

The project also includes the training at Sydney University of Saudi Arabian engineers in fire-fighting techniques. The first trainees will arrive in June for a four-week course.

In addition, a combustion laboratory is to be set up in Saudi Arabia probably at Jeddah, where Sydney University staff will advise Saudi Arabians on fire-fighting techniques.

Initially, the project is being financed by the Saudi Arabian Ministry of Petroleum and Mineral Rexources and the Ministry for Higher Education but later the Ministry of the Interior may contribute to the combustion laboratory.

Dr Henderson, who has worked on high speed aerodynamics in Britain, Germany and the United States, recently received the 1980 David Syme Research Prize from the University of Melbourne, for his work.

## Mooring line ships ordered

THREE offshore mooring line vessels, valued at $4.95 million (£2.25 million), have been ordered by Merseyside based Land and Marine Engineering Ltd from Cochrane Shipbuilders of Selby, Yorkshire, UK.

The 26m long vessels, for operation at offshore tanker loading terminals overseas, are to be registered in the UK and built to Bureau Veritas classification.

They will be powered by two twin Caterpillar D348TA engines (developing 725 B.H.P.), each driving – via Reintjes WAV 500B gearboxes – two Bamford fixed pitch propellers in Kort nozzles.

Scheduled for delivery by 31st December, 1981, the three vessels will have a speed of 10.25 knots and a ballard pull of 17.5 tonnes. Their design incorporates air conditioned accommodation for two officers and eight crew, plus two extra crew berths.

A foam water monitor and a detergent spraying facility are to be fitted. The clear after-deck, served by a single drum electric winch, will allow minor maintenance work to hoses etc.

***More information from: Bos Kalis Westminster Ltd, Westminster House, Blacknest, Alton, Hants GU34 4PU,UK.***

## Two topside jobs for CJB

BASIC engineering of the topside facilities and detailed design of the support structure for the Alwyn North drilling platform in the North Sea will be carried out by an Anglo-French joint venture led by CJB Offshore Ltd (part of the John Brown international group) – with CJB-Earl and Wright and Sofresid. The latter is a long-established French engineering company.

The contract signed with Total Oil Marine Ltd., operator for the field, calls for a fixed steel jacket with modular topsides. Provision will be made for two drilling rigs and accommodation for 220 persons.

Work has begun in the joint venture offices and installation of the platform in 130 metres of water in UK Block 3/9 is scheduled to take place in 1983.

The Alwyn field is expected to be developed by means of two fixed platforms.

Partners in the Alwyn field development are Total Oil Marine (33%), Elf UK (44.5%) and Aquitaine UK (22.5%).

CJB are also partners in work which has begun in in London on the engineering design of topside facilities for production platforms for the Tyra gasfield in the Danish sector of the North Sea.

The contract was awarded by Dansk Boreselskab to a joint venture formed by Geoplan A/S of Copenhagen and CJB. Dansk Boreselskab is the operator for D.U.C. (AP. Moller, Shell, Chevron and Texaco).

Valued at £7 million, the contract covers the detailed engineering of the process and treatment facilities on Tyra's two production platforms, as well as facilities on the associated gas flare platforms. The work will take place in both London and Copenhagen, and is scheduled for completion in fourteen months.

Geoplan A/S is a consulting subsidiary of the Kampsax Group and has been extensively engaged in the oil and gas industry in Denmark. Geoplan A/S will be assisted by Carl Bro Group, which is another Danish consulting engineering company.

## Maintenance for Benin offshore

MAINTENANCE, inspection and repair contracts for the three wellhead platforms to be installed on the Benin offshore oilfield (due west of Nigeria, between that country and Togo) will be handled by Saga Petroleum, operator for the Benin Government, from its Norwegian headquarters.

The three platforms, which will stand in 50m of water, are due to be delivered in November.

Delivery in April, 1982, is scheduled for two land-based storage tanks.

***More information from: Mr. Richard Barry, vice president production and development, Saga Petroeum A.S. and Co., Box 550, 1301 Sandvika, Norway.***

## New pressure water cleaner

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***More information from: Mr. K. T. Ronson, Bridon, Warmsworth Hall, Doncaster DN4. Tel: 0302 4010, ext. 265.***

TECHNOLOGY LETTER

## Water jetting and downhole tubulars

Dear Sir

REFERRING to the OMIR Technical Supplement of March 1981 we were very surprised at the article under the heading 'methods of cleaning steel tubulars – water jetting' as we have been very successful using high pressure equipment with abrasive injection using the natural media for the past five years, and as yet no other method has achieved such a high rate of cleaning, profile and quality required for high specification underwater inspection. Excellent results are also obtained in the preparation of critical surfaces in the splash zone areas prior to the application of epoxies on risers.

**B. Stockton,** managing director, Maritime Offshore Projects Ltd, Great Yarmouth, UK.

**Stephen E. Remp,** managing director, Ramco Oilfield and Marine Services Ltd, Aberdeen, author of the paper referred to, writes:

Mr Stockton appears to have misunderstood the terminology of 'downhole tubular' which is the pipe with threaded connections which actually produces the oil. He seems to have this confused with tubular steel as one might find on the jacket of an offshore platform. This being the case, water jetting is indeed well proven for underwater cleaning and in some instances as a suitable method for surface preparation prior to the application of protective coatings.

However, downhole production tubing, i.e. 'downhole tubulars', is a very different animal. I think Mr. Stockton would be hard pressed to give current examples of production tubing cleaned by high pressure water jetting in the North Sea area except for rust, scale and oil residue removal prior to abrasive blast cleaning.

guns. Later a more elaborate field gun will be made for wider tests to be carried out in isolated areas, such as rifle ranges, before a production prototype is developed.

The team will also work on the development of other methods of oil-well control, such as a special surface control capping device.

In April, Dr Henderson will visit Saudi Arabia to collect data on features like surface and bottom hole pressures of oil wells, their diameters and the nature of the fluids in them. This will enable him to define the oilwell fire problem so that research and development of the equipment can proceed.

While in Saudi Arabia, Dr Henderson will liaise with researchers at the King Abdul Aziz University.

The project also includes the training at Sydney University of Saudi Arabian engineers in fire-fighting techniques. The first trainees will arrive in June for a four-week course.

In addition, a combustion laboratory is to be set up in Saudi Arabia probably at Jeddah, where Sydney University staff will advise Saudi Arabians on fire-fighting techniques.

Initially, the project is being financed by the Saudi Arabian Ministry of Petroleum and Mineral Rexources and the Ministry for Higher Education but later the Ministry of the Interior may contribute to the combustion laboratory.

Dr Henderson, who has worked on high speed aerodynamics in Britain, Germany and the United States, recently received the 1980 David Syme Research Prize from the University of Melbourne, for his work.

## Mooring line ships ordered

THREE offshore mooring line vessels, valued at $4.95 million (£2.25 million), have been ordered by Merseyside based Land and Marine Engineering Ltd from Cochrane Shipbuilders of Selby, Yorkshire, UK.

The 26m long vessels, for operation at offshore tanker loading terminals overseas, are to be registered in the UK and built to Bureau Veritas classification.

They will be powered by two twin Caterpillar D348TA engines (developing 725 B.H.P.), each driving – via Reintjes WAV 500B gearboxes – two Bamford fixed pitch propellers in Kort nozzles.

Scheduled for delivery by 31st December, 1981, the three vessels will have a speed of 10.25 knots and a ballard pull of 17.5 tonnes. Their design incorporates air conditioned accommodation for two officers and eight crew, plus two extra crew berths.

A foam water monitor and a detergent spraying facility are to be fitted. The clear after-deck, served by a single drum electric winch, will allow minor maintenance work to hoses etc.

***More information from: Bos Kalis Westminster Ltd, Westminster House, Blacknest, Alton, Hants GU34 4PU,UK.***

## Two topside jobs for CJB

BASIC engineering of the topside facilities and detailed design of the support structure for the Alwyn North drilling platform in the North Sea will be carried out by an Anglo-French joint venture led by CJB Offshore Ltd (part of the John Brown international group) – with CJB-Earl and Wright and Sofresid. The latter is a long-established French engineering company.

The contract signed with Total Oil Marine Ltd., operator for the field, calls for a fixed steel jacket with modular topsides. Provision will be made for two drilling rigs and accommodation for 220 persons.

Work has begun in the joint venture offices and installation of the platform in 130 metres of water in UK Block 3/9 is scheduled to take place in 1983.

The Alwyn field is expected to be developed by means of two fixed platforms.

Partners in the Alwyn field development are Total Oil Marine (33%), Elf UK (44.5%) and Aquitaine UK (22.5%).

CJB are also partners in work which has begun in in London on the engineering design of topside facilities for production platforms for the Tyra gasfield in the Danish sector of the North Sea.

The contract was awarded by Dansk Boreselskab to a joint venture formed by Geoplan A/S of Copenhagen and CJB. Dansk Boreselskab is the operator for D.U.C. (AP. Moller, Shell, Chevron and Texaco).

Valued at £7 million, the contract covers the detailed engineering of the process and treatment facilities on Tyra's two production platforms, as well as facilities on the associated gas flare platforms. The work will take place in both London and Copenhagen, and is scheduled for completion in fourteen months.

Geoplan A/S is a consulting subsidiary of the Kampsax Group and has been extensively engaged in the oil and gas industry in Denmark. Geoplan A/S will be assisted by Carl Bro Group, which is another Danish consulting engineering company.

## Maintenance for Benin offshore

MAINTENANCE, inspection and repair contracts for the three wellhead platforms to be installed on the Benin offshore oilfield (due west of Nigeria, between that country and Togo) will be handled by Saga Petroleum, operator for the Benin Government, from its Norwegian headquarters.

The three platforms, which will stand in 50m of water, are due to be delivered in November.

Delivery in April, 1982, is scheduled for two land-based storage tanks.

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# N M R I REPORT

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Vol. 1 No. 2

MARCH 1982


## NMRI ATTENDS DIVING SYMPOSIUM

By Mark Allen

During early February the International Diving Symposium (IDS) was held in New Orleans, LA. This years symposium focused on new technology and improved methods of underwater work. The IDS is sponsored by the Association of Diving Contractors (ADC) and is internationally accepted as the premier meeting of its kind. The IDS has been held annually since 1970. The 3 day symposium is divided into three main events; formal presentations on new developments in diving, exhibits by diving firms such as equipment manufacturers, commercial diving companies, and workshops by ADC safety and medical committees. This year the U. S. Navy was represented by an exhibit from the Diving and Salvage Training Center in Panama City, FL. Representatives attending this years symposium from the Hyperbaric Medicine Program Center included CAPT Mark Bradley, Mr. John Naquin, Mr. Mitchell Witt, and Mr. Mark Allen. Also attending from NMRI were CAPT James Vorosmarti and Dr. Arthur Bachrach.

The ADC has as its goals "Communication, Education, Safety." As such, most of the themes of the formal presentations revolve around these goals. The speakers presented material on such subjects as new diving technology (such as underwater welding), medical effects of diving, government regulations, and diver training. One presentation dealt with a commercial diving school that purchased old Navy diving chambers, formerly at the Washington Navy Yard, and moved them to New York to use them to train new commercial divers. Another presentation dealt with atmospheric diving suits such as "JIM" which was the subject of research several years ago at NMRI.

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NAVAL MEDICAL RESEARCH INSTITUTE BETHESDA, MD 20814

COMMANDING OFFICER - CAPT J. VOROSMARTI MC, USN
EDITOR - LCDR R. M. GARRIGUES MSC, USN

There is a great interest among commercial diving companies to expand the services they offer their customers, principally the oil and marine construction companies working offshore. In trying to accomplish this goal and remain competitive, such innovations as remote control vehicles (RCV)*, one atmosphere vehicles, and suits have been developed. Such equipment is designed primarily for deep waters where economics, safety, and the type of work to be accomplished usually dictate their use. Such equipment does not replace a diver so much as it makes his job safer and more productive. Because of this, most of the interest generated by the exhibits was focused on these vehicles. One vehicle, named "Mantis" by its British developers, was a totally fascinating piece of equipment. "Mantis" is designed to accomodate one operator lying on his stomach. In front of the operator is a small console with TV screen, joystick, and other controls. (It was very exciting to this writer who climbed inside and was immediately reminded of being in a spacecraft type environment.) With the advantages of a submarine, "Mantis" has two manipulators for grabbing articles underwater and TV for relaying information

* * *


* Remote Control Vehicle "RCV225" manufactured by Hydro Products, Inc. This RCV comes with underwater light and television and is used primarily for inspections. Note thrusters on vehicle which provide propulsion for maneuvering.

to the surface. As companie's operations move into deeper waters, one atmosphere vehicles and suits will become more advantageous for certain kinds of work because of the cost of manned deepwater work.

The ADC workshops consisted of topics such as CPR in diving, and neurologic exams for laymen. One of the more interesting workshop topics involved ways to extend survival time in a lost diving bell. This presentation was by a representative of Kinergetics Incorporated of California. This firm manufactures a survival unit consisting of a parka, sleeping bag type garment, and small carbon dioxide units. When a diving bell is "lost" or its umbilical is cut off from the surface, any or all of the bell's life support capability may be lost. This type of accident places the divers inside the bell in a serious situation in two ways. The first danger is loss of body heat and consequent lowering of body core temperature. This heat loss is greatly accelerated due to the high helium concentration in the diver's breathing gas. The second danger is the build-up of carbon dioxide in the bell atmosphere. Kinergetics has developed the garments to retain body heat and the small scrubber unit to remove carbon dioxide from the diver's breathing gas. Each unit is designed to be carried in a waterproof container in the bell. Although the unit manufactured by Kinergetics has not, as of this writing, been used in an actual emergency, a similar unit has and is credited with helping to save the lives of the divers involved.

⊕ On 8 February, the Assistant Secretary of Defense for Manpower, Reserve Affairs and Logistics, approved the awarding of Humanitarian Service Medals to those Navy Personnel participating in the rescue and recovery operation pertaining to the 13 January Air Florida airline crash in the Potomac River. NMRI's Hyperbaric Medicine Program Center divers, considered to have earned this award by performing a major and direct recovery role beyond the normal expectations of duty include GMGC(DV) W. E. Brooks, GMC1(DV) G. P. Crow, HM1(DV) W. S. Ligget, HT1(DV) C. D. Goerlich, MM1(DV) J. R. Wilcox, and HT2(DV) C. Light.

"Those who expect to reap the blessings of freedom must, like men, undergo the fatigue of supporting it."

(Thomas Paine)

# The Hyperbaric Research Facility

The Hyperbaric Research Facility chamber complex features the most recent developments in chamber design and construction. It includes five separate dry chambers, a wet diving chamber mounted vertically beneath the center chamber, and the necessary systems for life support, operating control, communication, fire protection, water conditioning, instrumentation, and data acquisition. Three separate atmosphere conditioning systems control chamber temperature, humidity, oxygen, make-up, and the removal of carbon dioxide, particulate matter, and contaminants. Computer terminals in the control room provide immediate access to the central data processing equipment on the second floor of the building.

Three of the dry chambers and the wet chamber are rated to 1,000 psi; the other two dry chambers can be pressurized to 1,500 psi. The dry chambers, each of which is equipped with viewing ports, service locks for food and supplies, feed-through connections for monitoring instruments, and communication penetrations, have been designed to support diver habitation for over 90 days.

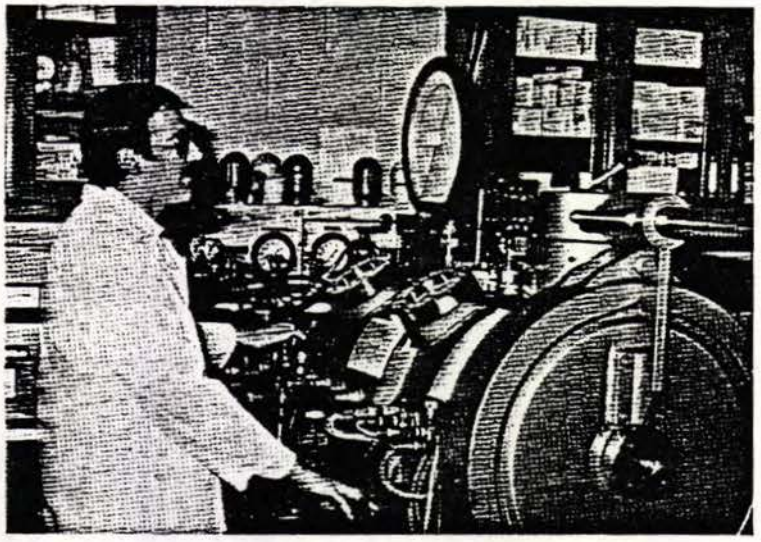
The central dry chamber provides access for diver excursions into the wet chamber, in which the environmental parameters of temperature, light level, and pressure are controlled by topside personnel to meet individual project requirements.

*Lower left: NMRI's new chamber complex. Above: The Hyperbaric Research Facility.*

Water temperature can be varied from 34° F to 110° F, providing a wide test range for thermal studies.

The 2-story Hyperbaric Research Facility houses the hyperbaric chamber complex, administrative offices, and various support areas including gas mixing and analysis, helium reclamation, and atmospheric conditioning facilities. Also within the 60,000-square-foot building are a comprehensive technical library, a complete computer facility for data storage, retrieval, and instant analysis, and 12 separate laboratories. These laboratories, staffed by research scientists from several NMRI departments, are individually designed and equipped to meet the needs of various scientific disciplines.

The extensive test and evaluation efforts within NMRI's hyperbaric research program are directed along three broad fronts. These concern solving the diving biomedical problems now facing fleet operational divers, solving the physiological problems currently identified for diving to 1,000 feet, and finding the safest and most efficient means of advancing man's depth capability to 2,500 feet.



*Lower right: Testing in a body plethysmograph. Above: One of NMRI's research laboratories.*

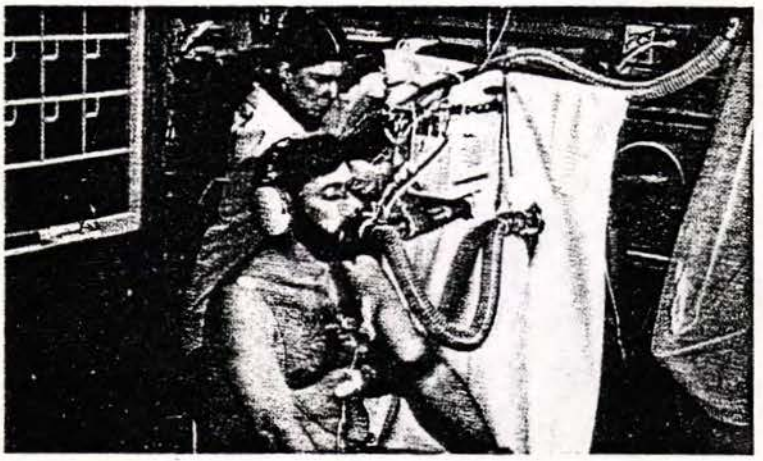
The specific areas of research encompassed in this program are:

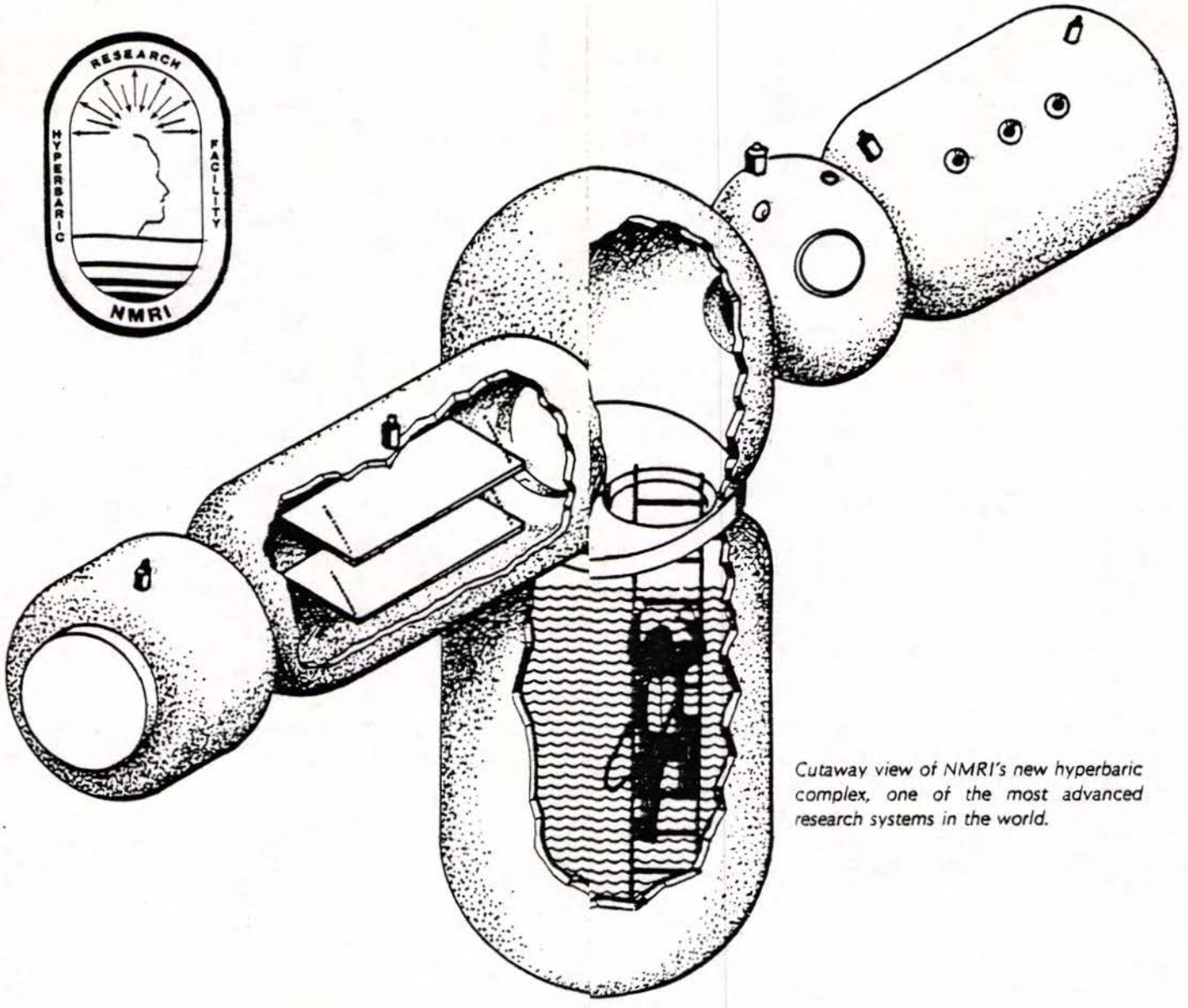
- The study of the principles and physiology underlying safe decompression.
- The development of improved methods to treat diving accidents.
- The study of respiratory function in the diving environment.
- The use of oxygen at increased pressures to enhance the safety and efficiency of diving operations.
- The effects of exposure to the diving environment on the cardiovascular system.
- The effects of thermal drain on the diver and the determination of the amount and distribution of heat needed to maintain a diver adequately safe and functional.
- High pressure biology.

NMRI was commissioned in 1942, when the need for Navy-oriented medical research in a multi-disciplined institute was realized. Located on the grounds of the National Naval Medical Center in Bethesda, Maryland, NMRI enjoys the benefit of easy access to the Washington, D.C. area's extensive scientific community.

NMRI's staff, which numbers over 400, consists of naval officers in the Medical, Dental, and Medical Service Corps; a nucleus of career civil service scientists, and a well-trained support force. Ongoing programs include such areas as biomedical science, clinical and experimental immunology, dental science, environmental bio-science, micro-biology, veterinary medical science, and hyperbaric medicine and physiology.

Though involved in these varied topics of study, NMRI is the Navy's leading laboratory for biomedical hyperbaric research. This was a primary reason for the decision of the U.S. Navy to build one of the world's most advanced hyperbaric research systems there. The expanded diving research and development capabilities provided by the Hyperbaric Research Facility have enhanced NMRI's ongoing policy of providing to the operating forces, equipment developers and general research community the information necessary to ensure the safety and effectiveness of the working diver at increasingly deeper depths.






*Cutaway view of NMRI's new hyperbaric complex, one of the most advanced research systems in the world.*

The Naval Medical Research Institute (NMRI) is the Navy's largest biomedical research facility. An activity sponsored by the Naval Medical Research and Development Command, NMRI conducts a multi-disciplined program that is dedicated to the improvement of the health, safety, and efficiency of naval personnel. The newest addition to NMRI's capabilities is the Hyperbaric Research Facility.

The Hyperbaric Research Facility houses a hyperbaric complex capable of simulating ocean depths down to 3,400 feet for both man and animal diving research. The primary emphasis of the experienced cadre of research scientists and technicians who operate and maintain this sophisticated facility is on solving the myriad of problems that man encounters in the undersea environment.

# WHO'S WHO

LCDR K. M. Shakir, Metabolic Research Branch, Casualty Care Program Center, has been elected as a Fellow of the American College of Physicians.

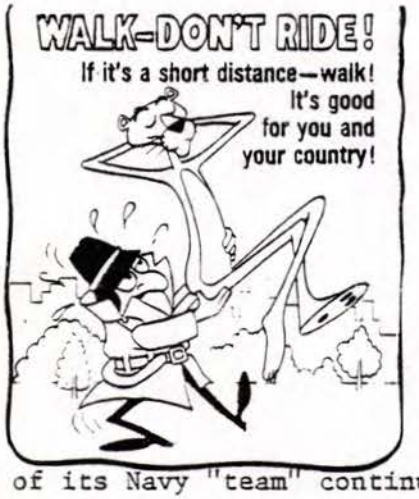
The event is several months past but the significance of it is lasting. Dr. Emilio Weiss, the distinguished occupant of NMRI's Chair of Science, has been elected to serve as the first president of the newly established American Society for Rickettsiology and Rickettsial Diseases. The election occurred at a major conference on rickettsial diseases sponsored by the National Institute of Allergy and Infectious Diseases, and held at the Rocky Mountain Laboratory in Hamilton, MT. The conference was attended by more than 100 rickettsiologists from the United States, Australia, England, France, and Switzerland.

CDR D. M. Strong, Transplantation Research Branch (TRB) Chief, Casualty Care Program Center, has received a letter of appreciation and a copy of a thesis entitled - Apropos Bone Allografts, from Dr. G. E. Friedlaender. Dr. Friedlaender, who previously served as a LCDR and Procurement Officer in the TRB, is now an Associate Professor in Orthopedic Surgery and Oncology at Yale School of Medicine, submitted the thesis in competition for the Kappa Delta Award.

* * *

CDR L. J. Jenkins, Jr., recently retired Officer in Charge of the NMRI Toxicology Detachment, Wright-Patterson AFB, has informed us that Dr. M. E. Andersen, M. L. Gargas, R. A. Jones, and himself, have received the Frank R. Blood Award from the Society of Toxicology. The award was in recognition for the best paper published in Toxicology and Applied Pharmacology for a 1980-81 12 month period. The paper, entitled "Determination of the Kinetic Constants for Metabolism of Inhaled Toxicants in Vivo Using Gas Uptake Measurements", was based on research conducted at the Detachment.

CAPT R. H. Watten, having had a long and productive service in the Navy Research Laboratory System, will become the Director Designate of the Gorgas Memorial Laboratory in Panama on 1 May.




As NMRI moves on and upward, individual members of its Navy "team" continue to exemplify themselves through receipt of special honors and promotions. Those to be recognized and congratulated this month include:

| | | | |
|---|---|---|---|
| Olof G. Carlson | COL | CCPC | Letter of Commendation |
| Lillian Carpio | HM1 | ADMIN | NMRI Sailor of the Year |
| Steven C. Vogelsang | HM2 | CCPC | Letter of Commendation |
| John Godish | GS-9 | HMPC | Promoted to GS-11 |
| Robin Cox | GS-5 | RSPC | Reclassified to WG-5 |
| Joseph Washington | WS-4(Temp) | RSPC | Permanent Appointment |

"New people" bring fresh ideas and energies to the positions they are expected to fill. With a sincere "Welcome Aboard" from everyone at NMRI, chart your course and proceed full steam ahead.

| | | | | |
|---|---|---|---|---|
| James P. Burans | LT (to) | IDPC (from) | OIS, NETC, Newport, RI |
| Mary Lynn Myhal | LTjg | IDPC | OIS, NETC, Newport, RI |
| Geoffrey A. Parr | ET2 | RSPC | AESD C-7, San Diego, CA |
| Jeffery Loomis | HM3 | IDPC | ASH NSHS, Ft. Sam Houston, TX |
| John Hilderbrandt | HA | CCPC | ASH NSHS, Ft. Sam Houston, TX |
| Mildred Bender | GS-6 | IDPC | Transfer |
| Samuel G. Hayden | WG-3 | RSPC | Transfer |
| Sammie L. Fullwood | WG-1 | ADMIN | Temporary |

For efforts expended, NMRI as a whole extends many thanks and best wishes to these who have contributed to our success: HM2 John E. Dietrich, HM2 Steven C. Vogelsang, Mary M. Matzen, and Doris N. Auer.

# SPORTS TWX

➤ On 7 March, CDR "Hank" Towle (CCPC) and LT Jim Palmieri (IDPC) joined approximately 1,500 other runners in the 20K "Bethesda Chase". Despite the cold, rain, and hills, Jim passed NNMC to finish 69th. in 73:03. Hank, in hot pursuit, finished in 96:00.

➤ "Ranger Rick"of the National Wildlife Federation and Ronald McDonald were on hand on 14 March to welcome approximately 2,000 runners to West Potomac Park and the 10K "Save the Eagle Run". The course was flat, with some wind, and LT Jim Palmieri (IDPC) finished 16th. overall (5th. in his age group of 30-34) in 34:46. LT Craig Thompson (IDPC) and LT Brad Halverson (CCPC) also represented NMRI well by finishing in 39:32 and 44:00 respectively.

➤ As a matter of interest, while interviewing LT Palmieri, it was discovered that he won last years NMRI Navy Relief race around the NNMC grounds by about 4 minutes. After watching the HMPC divers running this past week, he anticipates that he will win this years race by 6 minutes.

# CHECK POINTS

√ CDR Herbert J. Towle (CCPC), almost overwhelmed with gratitude for his coworkers, received two cakes and three pies for his 36th. birthday. At a loss for words, all he could say was that the cakes were the best he has ever eaten, and the pies the best he has ever worn.

√ For those of you eligible for upcoming sea duty, make note that another nuclear carrier, USS Carl Vinson, was commissioned on 12 March at Newport News. The Vinson, one of the three largest warships in the world, will join the USS Nimitz and USS Eisenhower.

√ Rural Health in the People's Republic of China is a new Fogarty International Center report of a delegation's trip to the country's outlying areas in June, 1978. The trip was sponsored by the Committee on Scholarly Communication with the People's Republic of China. The 10 member delegation's reported observations and accounts based on interviews with people at all levels of the Chinese health system. Single copies of this report may be obtained from the Publications Office, Fogarty International Center, Bldg. 38A, RM. 609, National Institute of Health, Bethesda, MD 20205.

√ As an educational aid, the following vocabulary is presented to assist in interpreting and speaking "Pentagonese".

OER: Officer Efficiency Report. A report card on a military officer, and an exotic art form. Unless you know how to read and write them and which adjectives count, you might be surprised that 90% of the officers place in the top 10%.

SUPERB: (as used in OERs and letters of commendation): Adequate. Example: "X is a superb officer." Translation: He messes up only once in a while.

OUTSTANDING: (Used often in OERs): Good.

GOOD: (Used rarely in OERs): Terrible.

REINVENTING THE WHEEL: Studying something your predecessor studied last year.

E-RING: The outer ring of the Pentagon, where the outside windows are; the high-rent district. *(To Be Continued)

➤ NMRI SOFTBALL, 1982 - The coach, players, and Command wish to thank everyone for their wholehearted support during the recent "submarine" luncheon. The profit of $300 will be used to purchase uniforms and finance tournament play throughout the season. Our next request for support will be for the April "dirty car wash". This annual car wash will be held in front of Bldg. 17, the date to be announced in the POD. NMRI's softball team is three time consecutive NNMC champions, and seeking a softball history making fourth. This achievement will closely follow in the same spotlight of NMRI's volleyball dynasty and its six straight championships. The competative spirit of the players, coach, and Command plays a large part in our success. As champions we defeat all comers, even renegade Centers within the Command. We consist of enlisteds, civilians, officers, an E-9 from Pittsburg, and especially our beloved "groupies". We love and need your support in the stands, and your standing in line for the subs and car wash. On to victory! (NAB)

"People without time for recreation are obliged eventually to find time for illness."

# OMIR

OFFSHORE MAINTENANCE INSPECTION & REPAIR

The only publication exclusively serving the offshore maintenance, inspection, repair and associated industries.

No. 6 Week ending March 20 1981


## World's most sophisticated diving medicine establishment

THE most sophisticated diving medicine establishment in the world will be completed in Bethesda, Maryland, in the next few weeks to provide the industry with the latest research into medical, physiological and technical aspects of high-pressure operations on divers.

The US Navy Medical Research Institution High Pressure Medicine Establishment, which has taken more than 10 years to plan and construct, includes a man-rated chamber complex, gas supply department, laboratories and computers.

Four main areas of research will be undertaken by the centre – bioengineering, medicine, physiology and hyperbaric operations. The director of the establishment is Captain Mark Bradley, a specialist in pulmonary physiology. He will have a staff of 30 specialists and researchers.

Dr. Bradley is himself carrying out a research programme into the effect on respiratory muscles during diving including the work load of a diver under high pressure in deep water.

A monitoring system has been developed to record a diver's breathing which is similar to an electrocardiograph. Four disc magnetometers, about 1" in diameter will be mounted on the back and front of the diver's rib cage. Results will be electronically calibrated.

In the respiratory field research is also being undertaken on controlling respiration; the effect of lungs in decompression situations, and breathing gas temperatures during operational diving.

The man-rated chamber complex will simulate decompression situations – three dry and one wet chamber will be capable of simulated pressurisation equivalent to a depth of 685 metres and a further two dry chambers to 1,036 metres.

This complex will enable researchers to work on a programme which will include the effect of temperature, exercise and oxygen toxicity during and after decompression.

The effect of drugs in post decompression situations will form an important study at the US Navy Medical Research Institution under Captain John Hallenbeck.

Air in the brain often leads to heartbeat irregularities and can cause fibrillation. Dr. Hallenbeck is researching drug treatment in this field.

Although there is worldwide research into overcoming cold and hypothermia on divers the Bethesda centre is also undertaking a programme in this field to determine the biological changes and the ultimate degrees of cold a diver can take.

OMIR correspondent in Houston

## Saudis back cannon to fight oil fires

THE Saudi Arabian Government has signed a contract with an Australian research team to develop a supersonic water cannon to extinguish offshore and onshore oilwell fires.

The Saudi Government has been so impressed by the technique, being developed in the University of Sydney's Department of Mechanical Engineering, that it has agreed to finance the project to more than a million Aust dollars over the next six years.

The aim is to develop a much safer and quicker method of extinguishing oilwell fires, which at the moment are costing the Saudis hundreds of millions of dollars.

The research team, led by Dr Roy Henderson, has developed a high speed water cannon which will fire jets of liquids at supersonic speeds. The team now plans to refine the technique to produce jets speeds greater than the momentum of oil spewing from the wells on fire, so dousing the blaze.

This technique would replace the most commonly-used method of putting out oilwell fires: a blast of high explosives which flows away the fuel.

Dr Henderson believes the project could introduce the first major developments in oilwell fire-fighting methods since 1950 and says that as far as he knows no new technology in the area has been developed anywhere in the world, although refinements have been made to existing methods.

The Saudi Government will give the University 390,000 dollars Aust for the first year of research and 90,000 dollars Aust every six months for the remainder of the project which is expected to take about six years.

The researchers have developed the water cannon from parts of four 17-pounder anti-tank World War Two

● Continued overleaf

## Shot-blasting, painting needed

SHOT-blasting and painting services will be required for the refurbishment of steel piers and cross braces on four jetties at the Mobil refinery in Coryton, Essex, England, where about half the 175,000b/d production is from North Sea oil.

One of the jetties is 200 yards long, the other three are 50 yards long.

Work will start this year in a 12-month programme spread over two years in the summer period.

***More information from: Mobil Oil Co., Coryton Refinery, Coryton, Essex.***

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OMIR


## Fifty divers at Bethesda

MORE news this week of the new diving medicine establishment, said to be the most sophisticated in the world, which will be completed shortly at Bethesda, Maryland, USA, to provide the industry with the latest research into medical, physiological and technical aspects of high pressure operations on divers.

Director of the US Navy Medical Research Institution High Pressure Medicine Establishment Captain Mark Bradley told *OMIR* that as well as a staff of 30 specialists, there will also be 80 support personnel and 50 divers, both service and civilian.

He also revealed that construction was now complete on the hyperbaric chamber complex and that it was now in the final stages of testing. 'It will be operational by early summer.'

He said the complex would enable simulated deep diving to be carried out by six people for up to 90 days at 3,400 ft. 'We have no plans to encapsulate people for this length of time at the moment but the facility is there.'

THE NEW ENVIRONMENTAL HEALTH EFFECTS LABORATORY

PREFACE:

New Navy commitments, particularly in manned underwater operations have created an acute need for major new laboratory facilities. The Naval Medical Research Institute is the Navy's largest and most completely staffed medical research, development, test and evaluative activity. Accordingly, many tasks for providing biomedical data in support of fleet needs will be assigned to a new laboratory facility to be constructed at the National Naval Medical Center in Bethesda, Maryland.

The new 36,000 square foot facility, called the Environmental Health Effects Laboratory is programmed to accommodate research efforts of the Institute's Environmental Biosciences, Behavioral Sciences, and Experimental Medicine Departments, as well as the Navy Toxicology Unit. Space has been allocated for a total of approximately 100 professional and technical pesonnel. In addition to the full-time staff at the Facility, cooperation with other departments of the Naval Medical Research Institute and the National Institutes of Health, among other facilities, will be a significant part of the research program.

New advances in undersea technology, engineering and biomedicine continue to expand the third dimension of man's activities in the ocean. Where in the past our knowledge of the seas was limited to surface-based observations, today, we are taking steps to develop knowledge, technology, and equipment to enable man to live and work usefully on the ocean floor for extended periods.

The marine science programs of the Department of the Navy are designed to provide the ocean science, engineering, development and operational techniques required for the conduct of assigned national security missions throughout the marine environment. Military marine science programs are thus directed toward enhancing U. S. capabilities for strategic deterrence, antisubmarine operations, support of amphibious operations, mine warfare, surveillance of the oceans, operations to protect essential shipping, and limited ground action.

MISSION:

Improved health care services and the solution of crucial fleet biomedical problems. In support of biomedical needs of the Fleet, the Environmental Health Effects Laboratory will provide a fundamental basic research effort in high pressure (hyperbaric) environments at great ocean depths. The facility will provide the deepest available hyperbaric chamber (3,300 feet) to expand existing research to the depths envisioned for potential Navy activities of the future, particularly in the areas of application of physiological and behavioral sciences to the solution of problems associated with saturation diving and man's ability to perform effectively under the sea. A strong animal model basic research effort is needed to test methods and techniques, as well as physiological changes

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associated with such activities. The orchestration of basic animal and human research is a crucial and proven scientific regimen. The following areas of research will be emphasized in the new facility:

(1) Cardiopulmonary Physiology. Included will be studies in ventilation/perfusion relationships, respiratory control, chest-wall mechanics, pulmonary oxygen toxicity. Cardiopulmonary studies will also include cardiovascular helium effects, respiratory flow, development of measurement devices, and measurement of cardiac output.

(2) Neurophysiology. Studies in neurophysiology will include hyperbaric neuromuscular pharmacology and membrane studies, as well as hyperbaric tissue studies of carbon dioxide effects. Also, neurophysiology of anesthesia under hyperbaric conditions and problems associated with the high pressure nervous syndrome, such as tremor and electroencephalographic changes. An important component of this research program will be the study, The Pathophysiology of Cerebral Air Embolism and Central Nervous System Decompression Sickness.

(3) Performance Physiology. Performance physiology will constitute a major study area, including anthropometric, biomechanical analyses of diver performance, and the measurement of physiological cost of work performed by divers.

(4) Inert Gas Uptake and Elimination. Research into the basic mechanisms of the uptake and elimination of inert gas by tissues will be an integral part of this program, which will investigate the basic mechanisms of decompressions. Additional work will study the pathophysiology of aseptic bone necrosis.

(5) Basic Toxicological Research Under Hyperbaric Exposures will concentrate on biochemical and physiological effects of trace contaminants in hyperbaric environments.

Anticipated time frame for completion of the Environmental Health Effects Laboratory is 1976, at an estimated cost of $11,000,000.

## DISTINGUISHED VISITORS

The Naval Medical Research Institute is world renowned and as such, numerous scientists from all over the world are eager to review our programs and tour the facilities and laboratories. This has been a record year so far for receiving these many scientists who are listed below.

Professor D. N. Walder, M.D., ChM, FRCS, FRCS (ED), Professor of Experimental Surgery at the University of Newcastle, consultant in Surgery to the Royal Navy and a member of the RN Clinical Research Working Party visited on 15-23 February 1974.

Rear Admiral Sadegh Hariri, Medical Corps, Imperial Iranian Navy, visited on 22 July 1974.

Dr. Anthony Curreri, President of the Uniformed Services Health Care University visited on 23 August 1974.

Colonel Stanley White, The Military Assistant for Medical and Life Sciences, Office of the Assistant Director (Environmental and Life Sciences) DDR&E visited on 10 October 1974.

Surgeon Rear Admiral (D) A. E. Cadman, Royal Navy visited on 22 October 1974.

Members of the Russian Delegation visited on 23 October 1974.

RADM Eugene P. Cronkite, MC, USNR, Brookhaven National Laboratories, Upton, L.I., visited on 5 November 1974.

Surgeon Rear Admiral James Watt, Surgeon General of the Royal Navy visited on 6 November 1974.

A delegation of Burmese scientists, under the Bureau of Education and Cultural Affairs Program of the Department of State visited on 7 November 1974.

Mr. Elmer Smith of the Federal Energy Administration was invited to speak on the initiation of a plan for an Institute-wide energy conservation program on 11 November 1974.

CAPT C. Gordon Watson, DC, USNR-R, Executive Director, American Dental Association, visited on 18 November 1974.

VISITING STUDENTS

NMRI, cognizant of the interest in science shown by high school students, has initiated a program whereby high school students are invited to the Institute to acquaint themselves with the various fields of research. To this date, the Institute has been visited by students from Wheaton High School, and nursing students from Pennsylvania. Members of the Biology Club, Walt Whitman High School and Robert H. Peary High School also toured the Institute. Students from Anacostia High School are expected to visit on 4 December 1974 and on 11 December, Gaithersburg High School students will visit.

FUTURE EVENTS

There is an NMRI Christmas party planned. It will be chaired by LCDR Yukna. The date: December 20th. Watch your Daily Bulletin for further information.

The Policy Advisory Council will hold its Annual Retreat on 10-13 December at Williamsburg, Va.

The Naval Medical Research and Development Command will hold ground breaking ceremonies for the New Environmental Health Effects Laboratory

at 9:30 A.M., Friday, December 6, 1974, in the NMRI Auditorium and at the construction site.

The distinguished visitors attending will be:

Rear Admiral R. G. Williams, Jr., MC, USN
Commanding Officer
National Naval Medical Center
Bethesda, Maryland

CAPT Oglevee, Chief of Staff (for RADM A. G. Esch, MC, USN, Commandant)
Naval District Washington
Washington Navy Yard
Washington, D. C.

CAPT J. E. Wilson, Deputy Commanding Officer (for CAPT Cox, Commanding Officer)
Naval Health Sciences Education & Training Command
National Naval Medical Center
Bethesda, Maryland

CAPT W. J. Green, Mr., MC, USN
Commanding Officer
Naval School of Health Care Admimistration
National Naval Medical Center
Bethesda, Maryland

Commanding Officer
Naval Regional Medical Center
Camp LeJeune, North Carolina

Major General Maxwell W. Stede (for LT General R. A. Patterson, USAF, MC)
Headquarters USAF/SG
Washington, D. C.

RADM P. Kaufman, MC, USN
Bureau of Medicine and Surgery (Code 4)
Navy Department
Washington, D. C.

RADM E. J. Rupnik, MC, USN
Bureau of Medicine and Surgery (Code 32)
Navy Department
Washington, D. C.

RADM C. L. Waite, MC, USN
Bureau of Medicine and Surgery (Code 5)
Navy Department
Washington, D. C.

Vice Admiral W. J. Moran, USN, Director
Research Development Test & Evaluation
Navy Department
Washington, D. C.

COL Richard Barquist(for Brig. Gen. K. R. Dirks, USA, MC, Commander)
U. S. Army Medical Research & Development Command
Washington, D. C.

Dr. Joseph Pollard, Director
Biological & Medical Science Division
Office of Naval Research
Arlington, Va.

Peter B. Bennett, M.D.
Department of Anesthesiology
Duke University School of Medicine
Durham, North Carolina

The Honorable J. Glenn Beall, Jr.
U. S. Senate
Washington, D. C.

The Honorable Gilbert Gude
House of Representatives
Washington, D. C.

Officer in Charge
Submarine Medical Research Laboratory
Groton, Conn.

MAJ General Robert Bernstein, MC, USA, Commander
Walter Reed Army Medical Center
Washington, D. C.

LT Thomas C. Marsden, CHC, USN will deliver the invocation for
CAPT Joseph A. Frank, CHC, USN
National Naval Medical Center
Bethesda, Md.

COL Stanley C. White, USAF, MC
Military Assistant for Medical & Life Sciences
The Pentagon
Washington, D. C.

Anthony R. Curreri, M.D., President
Uniformed Services University of the Health Sciences
Bethesda, Md.

Director, Armed Forces Radiobiology Research Institute
National Naval Medical Center
Bethesda, Md.

Commanding Officer
Naval Graduate Dental School
National Naval Medical Center
Bethesda, Md.

DID YOU KNOW THAT

the investigators at NMRI published 68 papers and 9 reports (a total of 77) in 1973 and as of 22 October 1974, there were 74 papers and 8 NMRI Reports published?

a new NMRI brochure is in the planning? It is just now in the formative stages and will be forthcoming sometime in the near future, hopefully before the first of the year?

it would be wonderful if everyone turned out for the seminars?

if you read the Daily Bulletin and the Plan of the Day you will be kept informed?

the man who can smile when things go wrong has thought of someone he can blame it on?

there are two ways of meeting difficulties; you alter the difficulties or you alter yourself to meet them?

I have yet to see any problem, however complicated, which when you looked at it the right way did not become still more complicated?

lack of communication enslaves the mind, fostering misunderstanding?

misunderstanding enslaves reasoning, fostering unfounded fears?

unfounded fears enslaves attitudes, fostering bigotry and racism?

bigotry and racism enslaves portions of humanity fostering anarchy?

anarchy enslaves a nation, fostering division, disorder, despair?

man is the only animal who creates verbal monsters in his own head, projects them on the outside world and then acts as if they exist?

Motivation is a disposition on the part of the employee to react to stimuli from the work environment. A satisfied employee will produce, and a highly satisfied employee will produce even more.

BUMED COMMAND BI-WEEKLY ACTIVITIES REPORT

22 June - 3 July 1981

Transfer of Reserve Officers to the Regular Navy. Effective 15 September 1981, Reserve officers must be able to complete 20 years active commissioned service before their 55th birthday to be eligible for transfer to regular Navy in accordance with DOPMA, this requirement is statutory and non-waiverable. The 55 year old age criterion does not apply to medical or dental officers or chaplains. Augmentation/continuation of permanent and temporary LDOs will be addressed by a separate NAVOP at a later date. Officers ineligible for transfer to the regular Navy under DOPMA restrictions have a final opportunity to apply for transfer in accordance with BUPERSMAN Article 1020120 and be screened by the August 1981 augmentation board. Applications for transfer to regular Navy should be sent via message to arrive at NMPC no later than 10 July 1981. CNO MESSAGE JUNE 1981

New Hyperbaric Research Facility Dedicated. On July 1, 1981, the U.S. Navy's Hyperbaric Research Facility was dedicated at the Naval Medical Research Institute, National Naval Medical Center, Bethesda, Maryland.

The Hyperbaric Research Facility is the Navy's deepest diving facility with a capability of simulating depths equivalent to 3,400 feet of sea water.

The Navy's needs for a deeper, longer diving capability requires bio-medical support to provide critical information regarding the physiological and psychological capabilities of the diver for safe, productive diving.

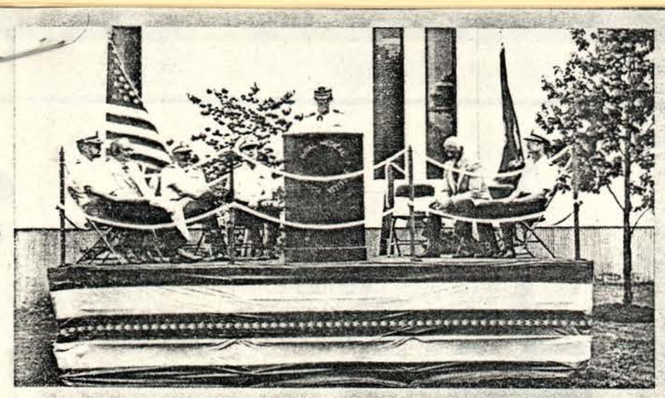
The Hyperbaric Research Facility will be dedicated entirely to research in hyperbaric medicine and physiology and is the Navy's lead facility in this field. As part of the Naval Medical Research Institute, personnel of the Hyperbaric Research Facility collaborate with other NMRI staff in all phases of medicine and physiology related to hyperbaric research.

Rear Admiral D. M. Smith, Director of the U.S. Navy's Deep Submergence Program will officiate at the ribbon cutting. The facility will be dedicated in the name of Captain Albert R. Behnke, Jr., MC, USN (Ret.). Dr. Behnke was a leader in Navy diving for many years and served at the Naval Medical Research Institute during World War II as Officer-in-Charge of NMRI's Experimental Diving Unit. LCDR ARRISON, NNMC Bethesda, PAO

Messages to CNMPC. CNMPC receives more than 200,000 messages per year from fleet and shore activities. To help in our efforts to respond as quickly as possible the following is provided: If there

# DEDICATION

WEDNESDAY, 1 JULY 1981



*Above: CAPT Vorosmarti addresses attendees at ceremony. Below: RADM Smith, CAPT Behnke and CAPT Vorosmarti cut the ribbon.*

## NMRI DEDICATES NEW HYPERBARIC COMPLEX

The Naval Medical Research Institute (NMRI) dedicated its new Hyperbaric Research Facility in a ribbon-cutting ceremony on 1 July 1981.

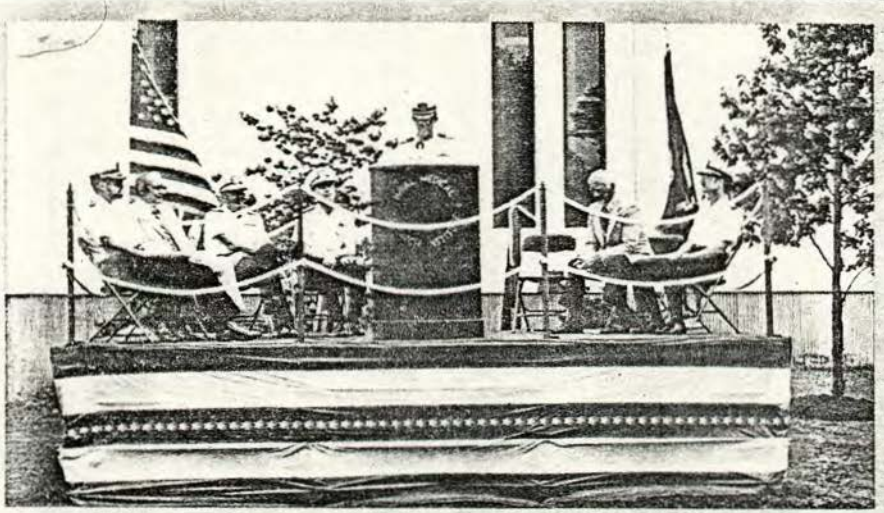
Primary speakers for the dedication were RADM Dickinson M. Smith, USN, Director, Deep Submergence Systems Division, Office of the Chief of Naval Operations; CAPT James Vorosmarti, Jr., MC, USN, NMRI's Commanding Officer; CAPT Kristopher M. Greene, MC, USN, from the Naval Medical Research Command; and CAPT Albert R. Behnke, Jr., MC, USN(Ret), in whose honor the new complex is dedicated. REV Donald R. Chandler, LCDR, MCS, USN(Ret), delivered the ceremony's invocation.

The Naval Medical Research Institute's Hyperbaric Research Facility will provide the U.S. Navy with the capability to conduct research at simulated depths equivalent to 3,360 feet of seawater—the only Navy facility capable of achieving this depth. This complex is dedicated totally to the prosecution of biomedical and physiological research which is directed toward enhancing the safety and health of Naval personnel engaged in undersea operations. The major areas of research to be addressed are as follows: 1) the study of the principles and physiology of safe decompression; 2) the development of improved methods to treat decompression sickness and cerebral air embolism; 3) the study of respiratory function in the diving environment; 4) oxygen toxicity and methods to allay oxygen poisoning; 5) the effects of exposure to the diving environment on cardiovascular performance; 6) the study of cold stress in the diving environment; 7) the effects of high pressure environments on cellular, and in particular the central nervous system and development of methods to ameliorate untoward effects.



# FACEPLATE

SUMMER 1981



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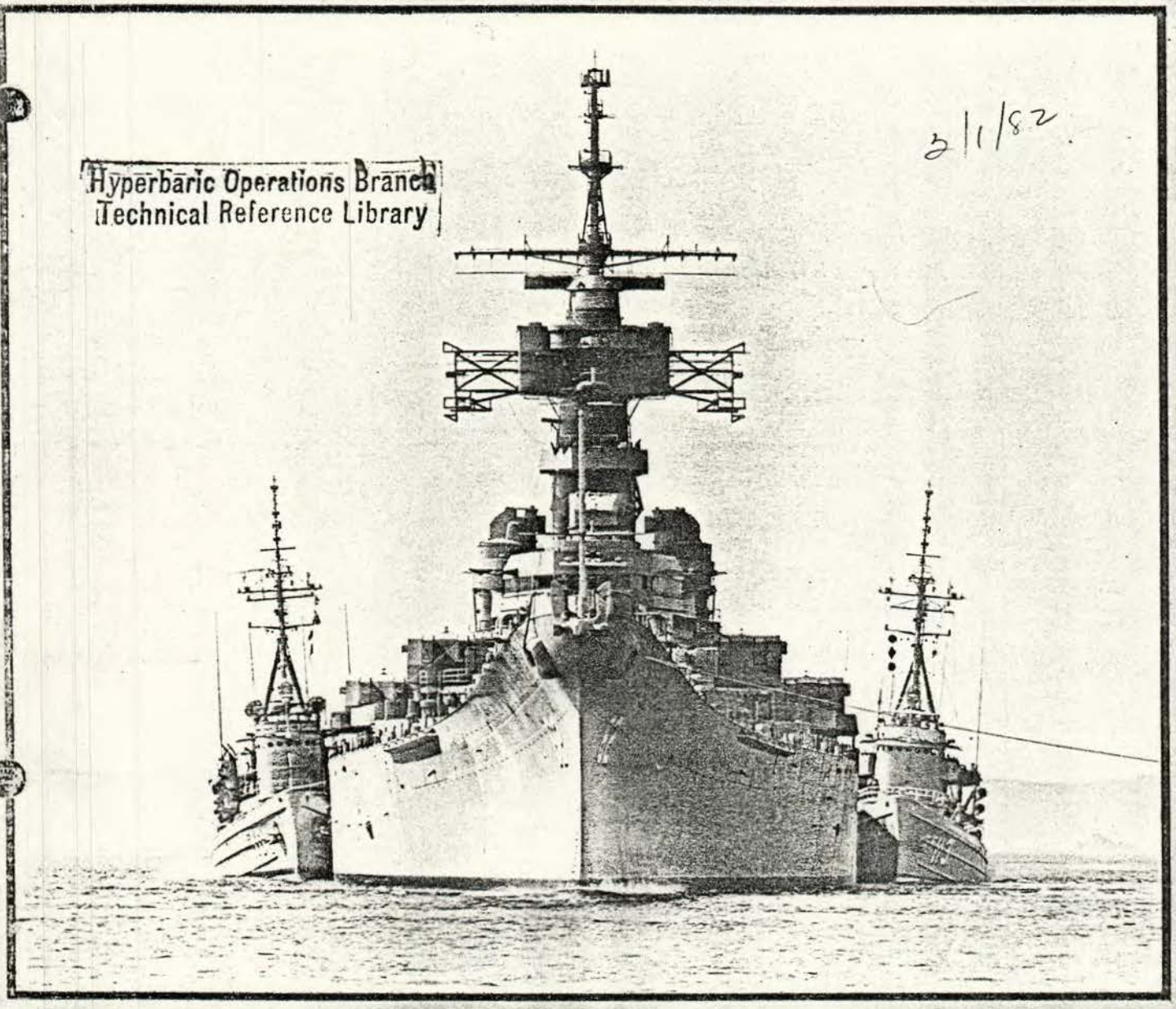

# FACEPLATE

SUMMER 1981

### *NMRI'S Hyperbaric Medicine Program Center*

# TACKLING DIVING PROBLEMS ON SEVEN FRONTS

*This is the second of a two-part article on the Naval Medical Research Institute (NMRI), the U.S. Navy's primary center for biomedical research in diving. The first part described NMRI's new Hyperbaric Research Facility and Chamber Complex (see FACEPLATE, Winter 1981).*

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NMRI is the major U.S. Navy facility in the Atlantic states capable of providing therapy for decompression sickness and air embolism, and also provides the capability of hyperbaric treatment for gas gangrene, carbon monoxide poisoning and other diseases amenable to hyperbaric oxygen therapy. The research program of the Hyperbaric Medicine Program Center is composed of projects which are balanced in such a manner as to fill immediate Fleet needs, as well as to develop new methods for effective diving to depths beyond current operational capabilities.

The diving biomedical research program of this Center encompass seven program areas.

## 1. Decompression Studies

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*Respiratory experiment with plethysmograph at one of NMRI's medical laboratories.*





ARTICLE 2

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to 1800, and took 12 days to reasonably cover the river bottom area within which it was possible to throw a gun.

**Subterranean Tangle**

If the bottom had been clean and sandy, as initial dives indicated, it would have been only *mildly miserable*, but an additional handicap of monumental proportions provided the nightmare that is the prime motivation for this literary effort.

The visibility was zero immediately below the water surface, so the descending line, jack-stay line, and hand signals from the tender were unquestionably the diver's life lines. The current was so strong that, unless the diver was lying flat on the bottom, it tended to remove his face mask, even with his back to the current.

Among our party, there were some who could tolerate the cold water better than others. Comedians attributed this ability to the amount of alcohol consumed the evening before, whereas the analytical mind attributed it to a larger layer of fat on these divers.

The one diver in the group most adversely affected by the cold water was a "Charles Atlas" type with no fat and all raw, bone muscle. He was the master diver supervising the operation and, therefore, didn't participate in these frigid excursions on a regular trick basis.

The lateral jack-stay movements were accomplished easily across the sandy bottom. Later, however, the gradual appearance of small, sunken trees became a veritable forest of enormous trees with branches of huge proportions, which eventually ensnared the jack-stay and wove it into an unbelievable tangle.

**Ditch the Gear?**

One diver attempting to travel along the fouled jack-stay fought his way toward the end, but unknowingly laced his umbilical through the trees many times. Finally, in a true, living nightmarish situation, he found himself standing upright facing the river current, unable to get down low, unable to turn around, completely fouled at every angle, and his face mask half torn off! His tender in the boat could not feel him and he could not feel the tender. The distressed diver was bordering on hysteria but afraid to ditch his diving gear in this entanglement.

Composure eventually returned and the diver managed the life line/air hose umbilical enough to send continuous jerks in a series of four-four-four pulls.

**"I've Got 4-4-4!"**

As stated earlier, a routine dive of 20 minutes was painfully chilling. On this dive, over 30 minutes had now passed. At last, the tender screamed out, "I've got 4-4-4 – he's in trouble!" The master diver, in swimming suit only, leaped into the water, tightening up his face mask in mid air, followed the diver's umbilical into the sunken jungle of trees, and, ignoring the excruciating cold, actually started breaking the limbs from the trees. The distressed diver could hear this over the roar of the river against his mask, which by now he held over his face with both hands.

The master diver eventually reached the ensnared diver and moved him a few inches at a time, while breaking away trees and clearing the jack-stay. Finally unfouling the diver's umbilical, he and the semi-petrified diver once more arrived at a reasonably clear bottom and then transited along the jack-stay back to the sanctuary of the diving platform. The entire elapsed time now was one hour and 30 minutes – an eternity for the parties concerned!

**From One Who's Been There**

If there is a lesson to be learned here, it is probably this: No matter what the existing circumstances, do not panic. And, have unquestioned faith and trust in your diving associates; supervisors are designated and assigned because they have proven that they can be entrusted with the lives of their men.

There is an unwritten understanding among professional divers – "I *am* my brother's keeper."

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Prior planning, eternal vigilance, and confidence in yourself as well as the professional expertise of your associates will invariably bring satisfactory results in any situation.

Oh, yes – I almost forgot about the murder weapon. The informant had lied; the gun had never been in the river at all.

*The "ensnared diver" of this story is the author; the master diver who came to his rescue, retired Chief Metalsmith Cyrus Earl Alleman. The 13 U.S. Navy divers involved in the operation received citations from South Carolina Governor James F. Byrnes.*

*A multi-disciplined staff investigates immediate and future U.S. Navy diving needs in seven different program areas.*

the need for decompression schedules for subsaturation helium-oxygen diving to 600 feet-of-seawater (FSW). Some operational scenarios involve decompression procedures that are beyond our present capability. Underwater Demolition Team/Seal missions involve complex dive profiles and include use of a constant oxygen breathing apparatus for which only limited schedules currently exist.

To meet both immediate and long-term operational requirements, we need to be able to formulate decompression schedules. Formulation of rational decompression schedules requires an understanding of the mechanisms governing inert gas transport in the human body. Therefore, our approach has involved a systematic approach to the measurement of mathematical modeling of the physical and biological processes that underlie decompression. Ongoing research includes the determination of the solubility of inert gases in body tissues and fluids, as well as the development of an understanding of the factors that regulate bubble formation and growth during decompression.

With the use of radioactive gases, we have obtained quantitative information regarding the kinetics of inert gas uptake, transport, and elimination in discreet portions of the body. Other projects are evaluating various environmental factors as they affect the decompression of divers. These factors include pulmonary status, exercise, cold, gaseous composition and pressure profile. The U.S. Navy's diver population now includes women. Therefore, we are performing studies to determine if decompression presents any hazard to fetal development. If it does, this would affect the operational status of female Navy divers. The final objective work in this area is to develop safer and faster decompression schedules for Fleet use.

### 2. Decompression Sickness and Embolism

A second program area is the development of improved methods to treat diving accidents, to wit: decompression sickness and cerebral air embolism. In order to rationally develop therapeutic procedures for decompression sickness and cerebral air embolism, we are seeking an understanding of the basic pathophysiological processes involved in these diseases. Research is in progress to develop improved recompression treatment guidelines. Since recompression therapy is not always curative, therapeutic adjuncts to recompression are needed. Much of this work, which involves evaluation of the efficacy of pharmacological agents to enhance recovery, is performed in clinical human trials.

### 3. Respiratory Research

Considerable research effort is directed to the study of respiratory function in the diving environment. Recent diving operations and experimental work has demonstrated that breathing resistance in some underwater breathing equipment is excessive. We have research which is defining the ventilatory loading which a diver can safely tolerate and which will provide an understanding of the response of the lungs and respiratory muscles to this loading. The results of this work will permit us to define the limits of resistance permissible in the divers' breathing equipment and provide the basis for the improved design and development of underwater breathing gear.

Other work in this area is determining the effects of both short and long exposure to various gases at high ambient pressures on respiratory function. For instance, work on respiratory control in diving is attempting to ascertain what is the normal respiratory state to be expected of divers in the hyperbaric environment. This information is needed as a baseline for the physiological monitoring of divers and for testing diving equipment.

Because of the considerable amount of heat loss from the respiratory system in deep diving, the U.S. Navy now requires that divers' breathing gas be heated during dives in excess of 500 FSW. Therefore, research is being conducted to determine the changes in lung function which occur while breathing hot or cold gases. This work will provide criteria for safe minimum and maximum temperatures of breathing gases in the diving environment.

Because of the loads imposed on the respiratory system by the diving environment, a diver's ability to sustain adequate gas exchange is impaired. To assist ventilation and gas exchange, we are examining methods which will enhance ventilation. The most promising technique presently is the use of a high-frequency, low-volume system which could be incorporated into a diver's breathing equipment.

### 4. Oxygen Poisoning

The use of oxygen at increased pressures can enhance the safety and efficiency of diving operations. It would be desirable if decompression time from deep dives could be shortened and the risk of decompression sickness reduced by increasing inspired oxygen concentration. At present, we do not know whether this is feasible or safe to do. Thus, we are conducting research which will allow for the early detection of oxygen poisoning as well as quantitatively determining the rate of development, severity, and rate of recovery from varying degrees of oxygen poisoning. This work will provide the basis for determining whether present schedules for oxygen exposure (including recompression therapy schedules) should be modified.

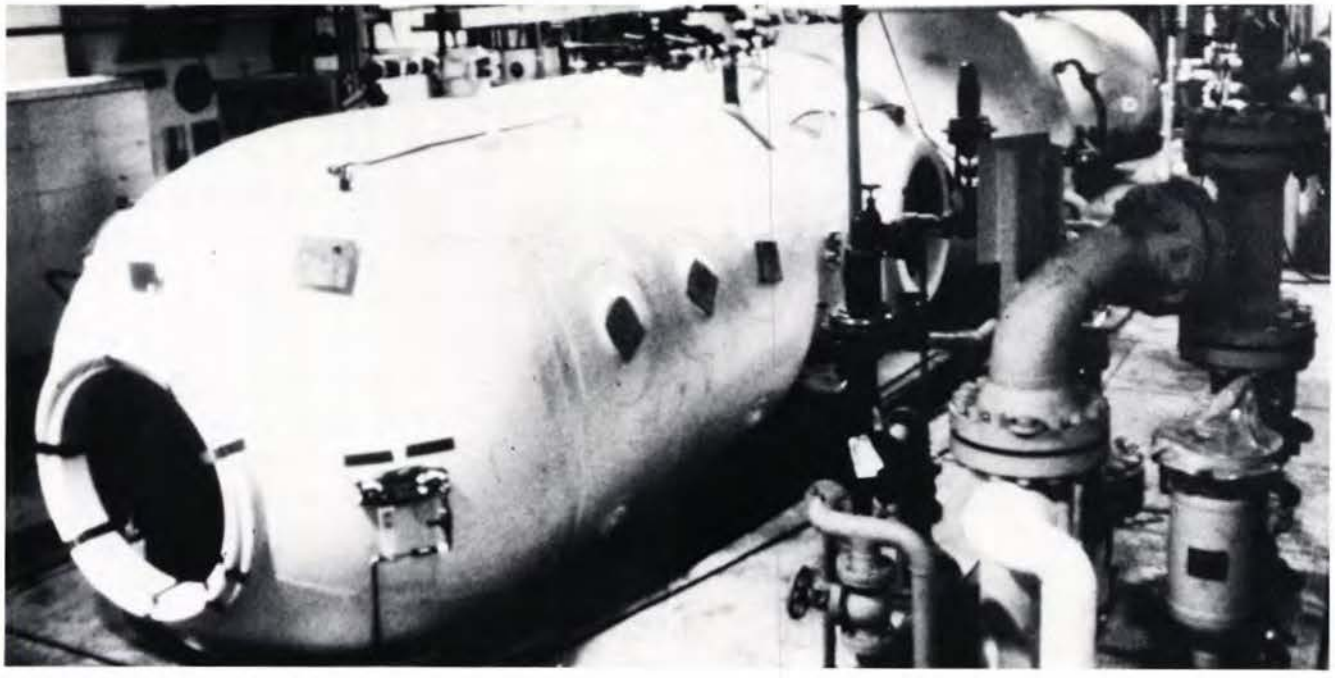
### 5. Effects of Exposure

The effects of exposure to the diving environment on cardiovascular performance are being studied. Of particular interest is the effect of exposure on cardiac output and regional blood flow, since changes in either of these can limit work capacity and alter the uptake and elimination of inert gas. Work in this laboratory has shown that cardiac arrhythmias and other forms of cardiovascular dysfunction can occur as a result of arterial air embolism and decompression sickness. Therefore, we have work ongoing which is devising and testing better therapeutic approaches for the treatment of these problems.

### 6. Thermal Studies

Cold is pervasive in the diving environment. Where thermal drain is encountered, a diver's performance is first affected and subsequently his safety may be jeopardized to the point where mere survival is at stake. The study of cold stress in diving has several objectives. First of all, we are working to determine the physiological events that occur in cold stress and to define suitable measurement or combinations of measurements to indicate the

*NMRI's Hyperbaric Research Facility.*



*A view of the Hyperbaric Chamber Complex.*

degree of cold stress. Secondly, we are working to determine the amount and distribution of heat needed to maintain a diver in an adequate, functional and safe condition. This will permit us to propose guidelines to equipment designers with regard to the heating requirements of a diver for optimal function.

We are also beginning research which will provide improved procedures for rewarming a hypothermic diver in each of the operational settings where divers work.

### 7. High-Pressure Biology

The seventh, and final program area, high-pressure biology, comprises a potpourri of research projects concerned with defining the effects of high-pressure environments on divers.

Diving beyond 1,000 FSW is currently tenuous because of problems arising in divers in the form of tremors, vertigo, nausea, and certain performance problems. These problems are collectively named the high-pressure nervous syndrome. Because it is necessary to determine whether man can effectively dive beyond 1,000 FSW and perform work safely, research is in progress to define the nature of this disorder and the fundamental mechanisms involved. As part of this research, we are attempting to devise methods to attenuate or eliminate the high-pressure nervous syndrome in Navy personnel. Both short- and long-term exposure to hyperbaric environments may potentially have detrimental effects on body tissues and cells. Research is therefore quantifying the effects that these environments have in the functional capacity of the immune and renal systems, as well as on certain constituents of blood, such as platelets. The final work unit in this program area focuses on task performance of divers in various conditions. This research is providing desriptive and quantitative data on performance degradation associated with various environmental factors, and the development of methods to minimize performance degradation by the application of human engineering techniques.

### Diving Research and Beyond

To prosecute this research program, the Hyperbaric Medicine Program Center has an investigative staff which is multi-disciplined. Investigators trained in the physical sciences, such as physics and chemical and electrical engineering, work hand-in-glove with neurophysiologists, cardiovascular and respiratory physiologists, and biochemists.

As can be seen, this is an extraordinarily large and diverse research effort which is providing answers and solutions to major operational problems in diving today. Because the conduct of excellent basic science and elucidation of mechanisms are fundamental prerequisites to the development of solutions to Fleet problems, there is considerable spinoff of our research from many areas of clinical medicine which are far afield from diving. Examples of these areas are the improved monitoring of critically ill patients, as well as improved methods for treatment of stroke and spinal cord injury.

# THE RECOVERY OF AIR FLORIDA FLIGHT 90

*LCDR Stephen W. Delaplane, USN*
*and PH2 Mark Faram, USN*
*Mobile Diving and Salvage Unit TWO*

**U.S. Army photos by Sp4 Alan Adams and SSG Gary Kieffer, courtesy Maj. Sam Bruce.**

On January 13, 1982, the late afternoon snow was falling like pillow cases in the nation's capital. Many government offices had already closed, sending thousands of employees to fight their way home through frozen streets. National Airport had secured operations earlier, owing to the extremely poor visibility and runway conditions, but had reopened at about 1500.

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*Recovery operations in progress on the Potomac River at the 14th Street Bridge. Washington National Airport, one mile south, is visible at top of photo.*

# A LOOK AT NMRI'S NEW HYPERBARIC RESEARCH FACILITY

*The Naval Medical Research Institute (NMRI) is the Navy's largest biomedical research facility. The newest addition to NMRI's capabilities is the Hyperbaric Research Facility, which houses a hyperbaric chamber complex capable of simulating ocean depths down to 3400 feet-of-seawater.*

*John C. Naquin*
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The Naval Medical Research Institute (NMRI), located in Bethesda, Maryland, is a tenant activity of the National Naval Medical Center. It is at the Naval Medical Research Institute that 90 percent of the Navy's basic hyperbaric medical research is conducted.

Within one hour from Bethesda are 49 research-related facilities, ranging from universities to marine oceanographic activities. Because of the accessibility to this scientific community, the Navy selected NMRI as the site to construct a new hyperbaric research facility.

The Hyperbaric Research Facility is contained in a two-story building of approximately 36,000 square feet. The upper floor is composed of administration and laboratory spaces. The lower floor is dedicated to the Chamber Complex.

The Facility's mission is to conduct fundamental research on problems confronting the operating forces in the undersea environment. Specifically, the Facility is concerned with research into the biomedical and physiological phenomena experienced in depths to 3,360 feet-of-seawater (FSW).

The Pressure Complex consists of five interconnected, high-yield steel pressure vessels, totaling approximately 3,000 standard cubic feet water volume. The Man-Rated Chamber Complex consists of three permanently joined pressure vessels, each capable of being pressurized to a simulated depth of 2,250 FSW (68 ATM).

The diving chamber is composed of a sphere (or igloo) atop a cylinder (wet pot). The wet pot can be filled with water and undersea operations simulated by fully equipped divers.

The living chamber is a cylinder in which the divers or occupants can work and live at simulated depths for extended periods of time. It contains bunks, wash basin and water closet.

The outer chamber is a cylinder used primarily as an elevator between the surface and operational proceedings at depth.

The Man-Rated Chamber Complex 1500 consists of two permanently-joined pressure vessels, each capable of being pressurized to a simulated depth of 3,360 FSW. The research chamber is a large cylinder in which the diver or occupant can perform programmed exercises or simulated underwater tasks. The interim chamber is a sphere used primarily as an elevator between the surface and either the research chamber or the diving chamber.

The following are some of the major sub-systems and their functions:

- The standby power system provides electrical power to critical loads in the event of both a primary and secondary power failure.
- The gas farm consists of an arrangement of high-pressure gas storage cylinders, compressors, and associated piping, valves, and controls capable of storing the required volume of helium, air, oxygen, and mixed-gas for life support, medical and emergency use, and distribution to the required gas systems in all chambers. The gas farm also includes a reserve and emergency gas supplies.
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(Continued on pg. 20)



ARTICLE 1

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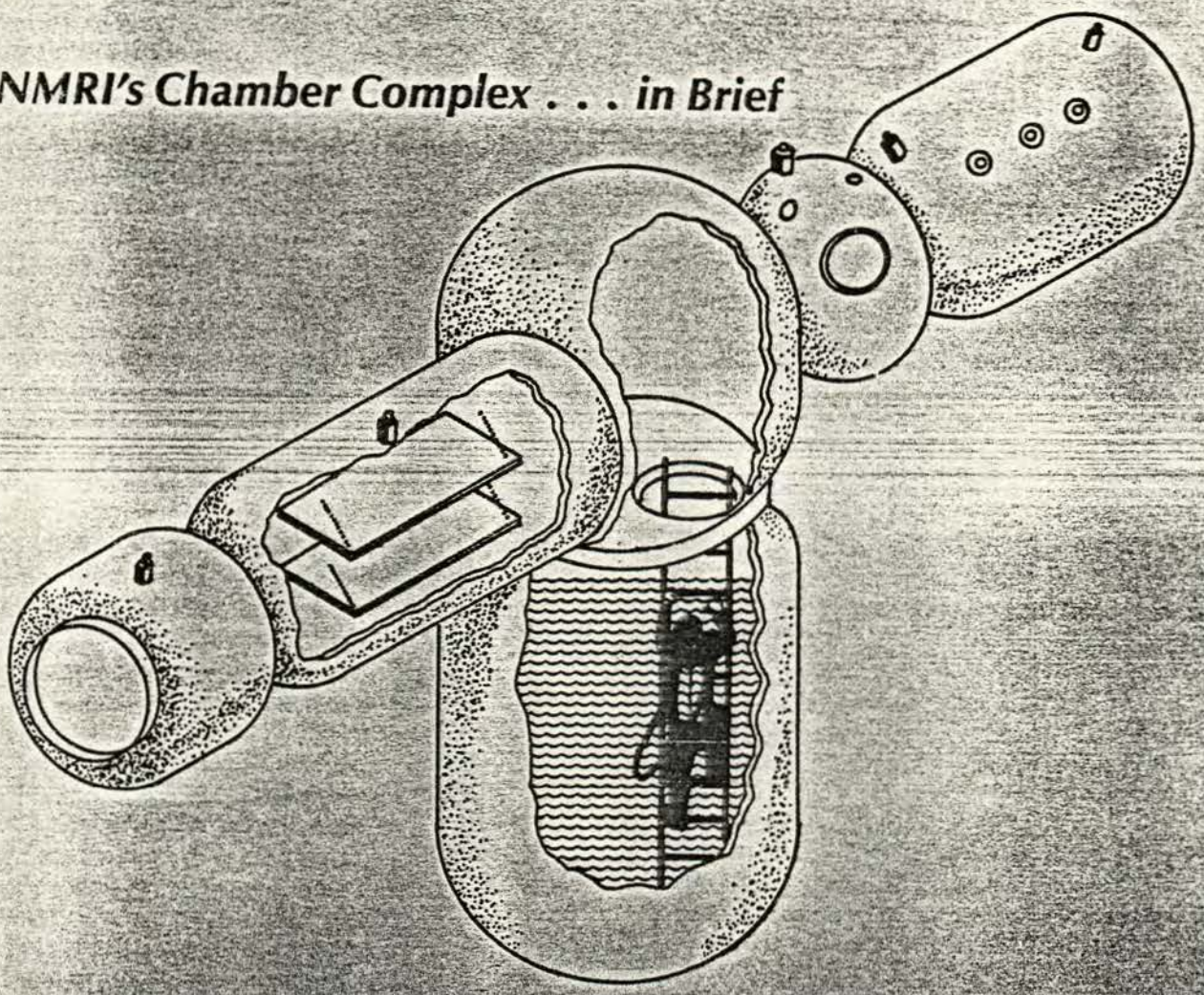
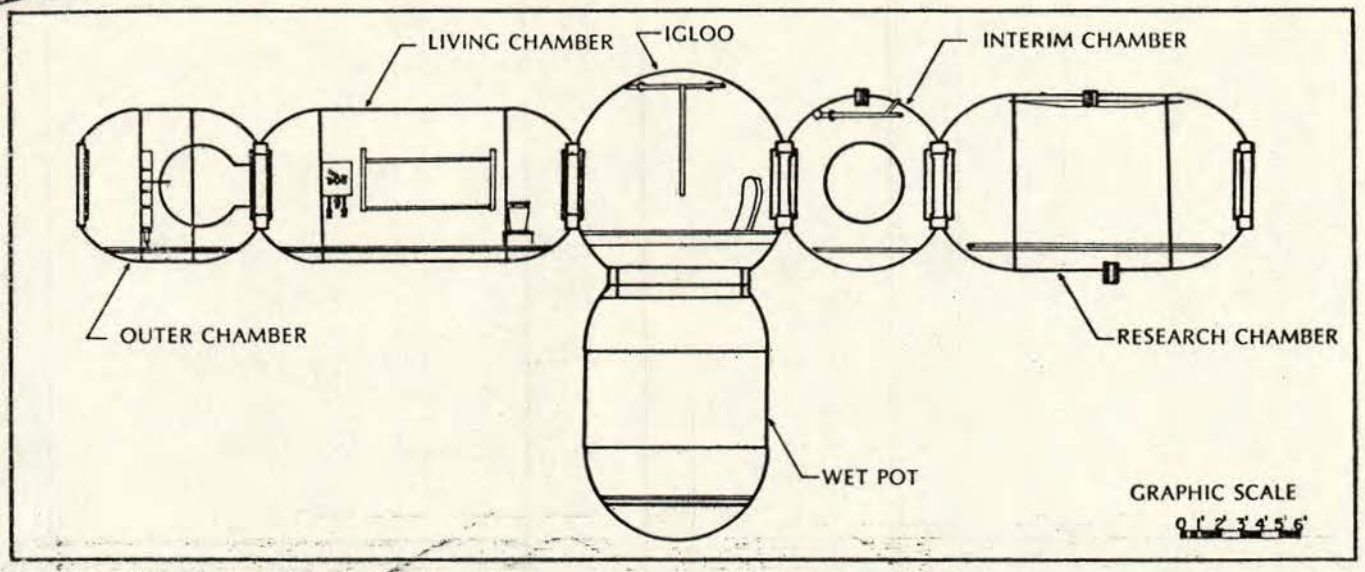
# NMRI's Chamber Complex . . . in Brief



The Hyperbaric Research Facility chamber complex features the most recent developments in chamber design and construction. It includes five separate dry chambers, a wet diving chamber mounted vertically beneath the center chamber, and the necessary systems for life support, operating control, communication, fire protection, water conditioning, instrumentation, and data acquisition. Three separate atmosphere conditioning systems control chamber temperature, humidity, oxygen make-up, and the removal of carbon dioxide, particulate matter, and contaminants. Computer terminals in the control room provide immediate access to the central data processing equipment on the second floor of the building.

Three of the dry chambers and the wet chamber are rated to 1,000 psi; the other two dry chambers can be pressurized to 1,500 psi. The dry chambers, each of which is equipped with viewing ports, service locks for food and supplies, feed-through connections for monitoring instruments, and communication penetrations, have been designed to support diver habitation for 90 days.

The central dry chamber provides access for diver excursions into the wet chamber, in which the environmental parameters of temperature, light level, and pressure are controlled by topside personnel to meet individual project requirements. Water temperature can be varied from 34°F to 110°F, providing a wide test range for thermal studies.

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communication between chamber occupants and operator personnel, plus video monitoring of chamber activity. The system consists of four separate sub-systems which are as follows: head-set communication system, intercom system, sound-powered system, and a closed-circuit television system which allows the chamber operator to observe the interior of each chamber.

- The built-in-breathing system provides the capability to supply chamber occupants with breathing gases which may differ from the chamber atmosphere. The gases and gas mixtures used for experimentation, medical treatment, and casualty management are supplied to the chamber occupants through an oral-nasal mask. Mixed-gas can be supplied for all chamber pressures.

- The oxygen makeup system provides for automatic replenishment of consumed oxygen with overriding manual injection capability for each of the chambers.

- The inert gas pressurization and vent system for the complex provides for pressurization and depressurization of all chambers. The chambers can be pressurized independently or in any combination.

- The air pressurization system supplies the Complex with 360 psig of air for dives to 250 FSW.

- The sanitary system removes liquid and solid wastes from the chamber under pressure conditions. The research, living, and diving chambers each have a complete sanitary system.

- The fire-extinguishing system is a wet pipe system utilizing water as the extinguishing agent. Each of the chambers has a complete and separate system.

- The potable-water system provides water for drinking and sanitary purposes to the living and diving chambers. Each chamber receives water from its own pressurized tank outside the chamber. The tank water level, system pressure, and hot water temperature are all automatically controlled.

- The test media or diving water conditioning system controls the temperature, turbidity, and microorganism content of the water in the diving chamber. The temperature control of the system is completely automatic. Turbidity and microorganism content are regulated through filters.

- The atmosphere conditioning systems control the temperature, humidity, carbon dioxide, contaminant, and particulate content of the chamber environment. Three closed-loop systems provide direct environmental control of the hyperbaric chambers.

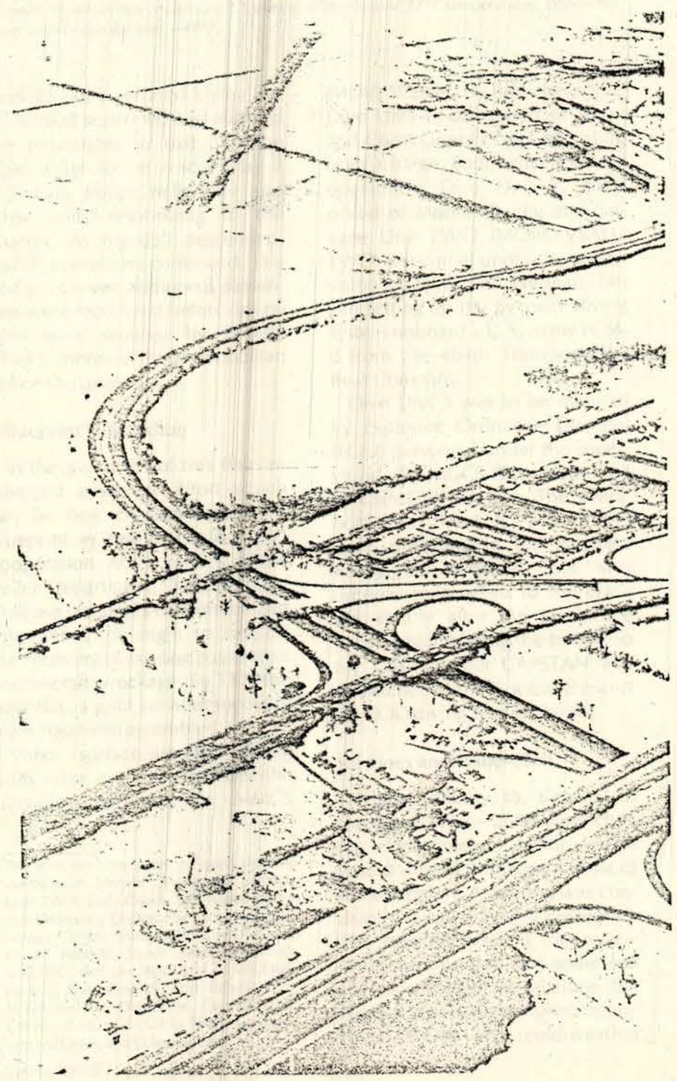
- The gas analysis system provides the means to analyze the various gases used throughout the facility. The gas analysis system consists of four subsystems: the sample input subsystem, carbon dioxide analyzers, oxygen analyzers, and trace gas analysis by a computerized scanning-type mass spectrometer and gas chromatograph.

During operations, the hyperbaric complex is staffed by both military and civilian personnel, and is capable of supporting six human subjects inside the chambers for as long as three months. One of the most sophisticated hyperbaric systems in the world, the NMRI Chamber Complex is dedicated to the basic research necessary to extend man's depth and time mobility beneath the ocean.

*Next issue: FACEPLATE will feature NMRI's ongoing biomedical research activities in seven different program areas.*

# FACEPLATE

# THE RECOVERY OF AIR FLORIDA FLIGHT 90



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U.S. Army photos by Sp4 Alan Adams and SSG Gary Kieffer, courtesy Maj. Sam Bruce.

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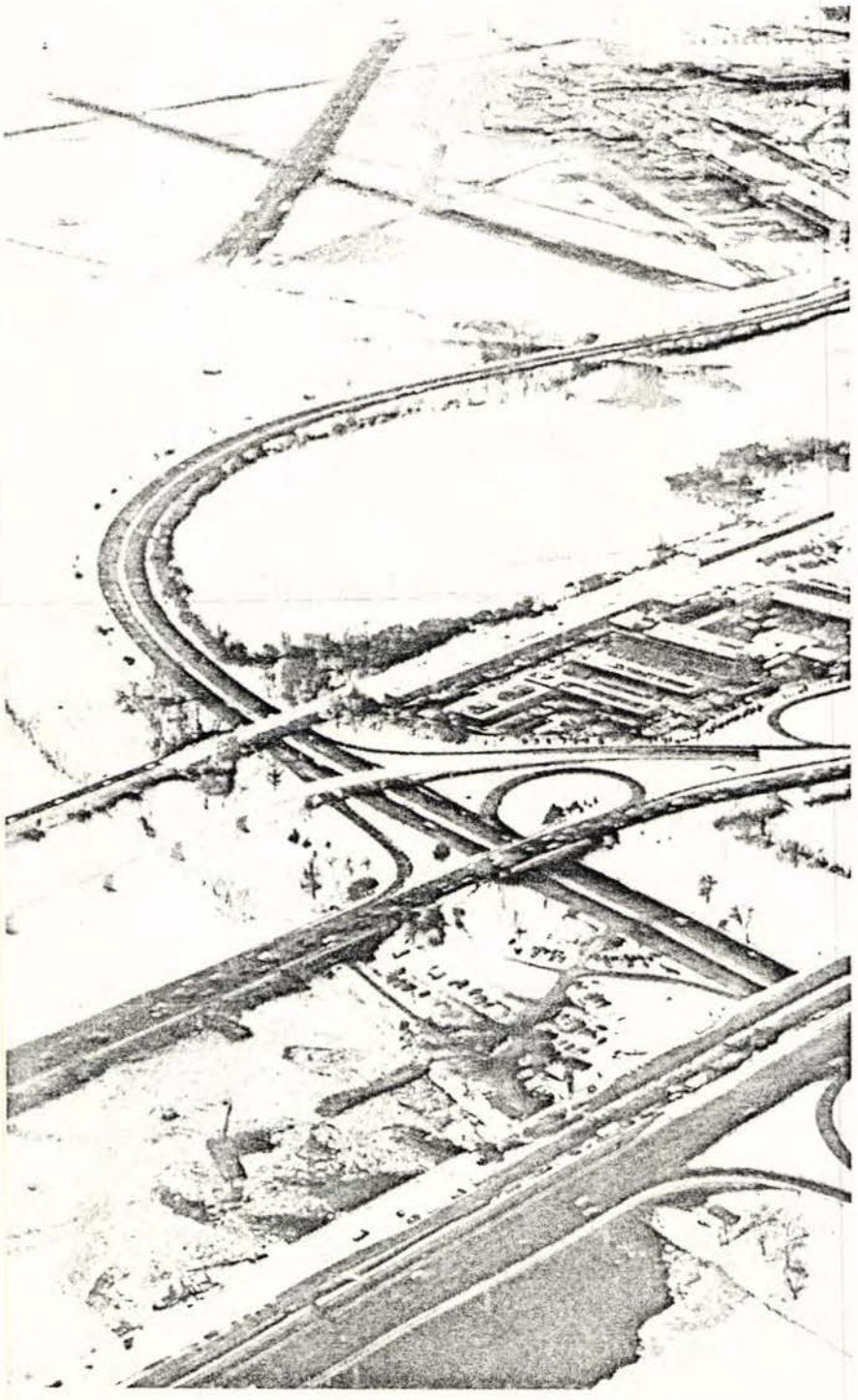

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"This salvage operation was a tragic human drama of unusual proportion. The members of the joint services team shared the physical and emotional stress, and responded with a spirit of spontaneous cooperation, selfless professional dedication, and extraordinary compassion . . . . They faced almost impossible odds and extreme adversities of weather. Yet, with a methodical perseverance and resolve, they achieved the impossible."

LCDR S.W. Delaplane, USN, On-Scene Commander

*Recovery of tail section on January 17, during relatively mild 17°F temperatures. Wind-chill factor on previous day was −47°F.*

fuselage like a serrated knife. The tail section separated and allowed five passengers to exit into the frigid water to be rescued by a U.S. Park Police helicopter and other units responding to the disaster. As nightfall descended, rescue operations continued. The bodies of seven additional passengers were recovered before operations were secured by Deputy Chief Connors of the Metropolitan Police Department.

### "Blueprint" Operation

In the aftermath of this disaster emerged a salvage effort which can be best characterized as a blueprint in professionalism and cooperation. At the request of the Police Department, Department of Defense resources were mobilized throughout the night to support the recovery of missing passengers and aircraft wreckage. By 1300 the next day, a joint services recovery team had been assembled.*

Three surface-supplied diving units were established under the overall supervision of MMCS (MDV) Wetzel. By mid-afternoon, Dive Unit 1, comprised of Army and Coast Guard divers operating from a barge, commenced survey operations. Dive Unit 2, comprised of Mobile Diving and Salvage Unit TWO (MOBDIVSALU TWO) personnel under the supervision of MMC(DV) Herman, began setting up the fly-away diving system onboard a U.S. Army LCM-8 from the 464th Transportation Boat Company.

Dive Unit 3 was to be manned by Explosive Ordnance Disposal (EOD) personnel under the supervision of GMGCS Richardson and HTCS(MDV) LeJeune. The diving boat from the EOD School had been operating in the Patuxent River, in Maryland, but was ordered to proceed to the crash site shortly after the crash. Ice jams were hindering the transit, so the USCG Cutter CAPSTAN was dispatched to break ice and escort the EOD diving boat to the site.

### Ice Floes and Wind-Chill

Friday, January 15, dawned in the glaze of a −20°F wind-chill, an environmental factor which would prevail throughout most of the operation. A briefing was conducted for all dive unit personnel. The briefing detailed the operational organization and addressed the aspects of press relations, the body recovery procedures, operational safety and cold-weather

*The joint services team included detachments from Mobile Diving and Salvage Unit TWO, Little Creek, VA; Naval Explosive Ordnance Disposal School and Technology Center, Indian Head, MD; Coast Guard Atlantic Strike Team, Elizabeth City, NC; and the 86th and 115th Engineering Detachments, Fort Belvoir, VA. LCDR Stephen Delaplane, Commanding Officer of MOBDIVSALU TWO, was designated On-Scene Commander.

*Above: Crash site at bridge, near Washington Monument. Right: U.S. Army divers from 30th Engineering Battalion, Ft. Belvoir. Below: U.S. Navy MK 12 diver from MOB-DIVSALU TWO.*

medical precautions. In some respects, this "all-hands" meeting was like a class reunion, as many Navy, Army and Coast Guard divers were reacquainted after graduating from the Navy diver training facilities at the Navy Yard in Washington, D.C., and Panama City, Florida.

After breaking and moving the ice floes which had formed overnight, Dive Units 1 and 2 set about their assignments. Initial surveys showed that the aircraft was badly demolished but well concentrated. As bodies were located, they were brought to the surface and turned over to representatives from the Medical Examiners Office. After a 36-hour transit, the EOD dive boat arrived in the afternoon.

Diving operations commenced from all three dive units at 0800, Saturday, January 16. U.S. Army engineers set up a grid of the impact area which was utilized to establish the location of the wreckage. Surveyors on the beach would, at the request of Dive Unit supervisors, provide a grid location which was correlated to a specific diver's location. As a result, a very detailed map of the impact area was developed.

The flight recorders were of very high interest to the National Transportation Safety Board investigation. These units were equipped with underwater "pingers" and had been located by divers. However, access and recovery were precluded by a large pile of debris which was resting on top of them. At the end of the day, the tail section was rigged for lifting; the bodies of 50 victims had been recovered so far.

The next day, winds of 30 knots plunged the wind chill to −47°F and necessitated terminating diving operations. The respective teams spent most of the day just running equipment and maintaining adequate cold weather protection. Diving operations were attempted, but exhaust and air control valves kept freezing in the frigid air.

### Into High Gear

Monday, January 17, brought a "tropical heat wave" with temperatures rising to 17°F. The tail section was lifted and an additional seven bodies were recovered. A U.S. Army underwater radar topography unit sonar-scanned the impact area by helicopter and inflatable boat to develop an underwater picture of the wreckage. The results were then coordinated with dive unit assignments.

Attempts to lift the main fuselage and cockpit on January 19 had not been successful. However, the next morning, the flight recorders were located and recovered on the first dive. The main fuselage was rerigged and successfully lifted. The cockpit and instruments were also recovered. At the conclusion of this "tonnage day", approximately two-thirds of the wreckage had been recovered; all but six bodies had been recovered.

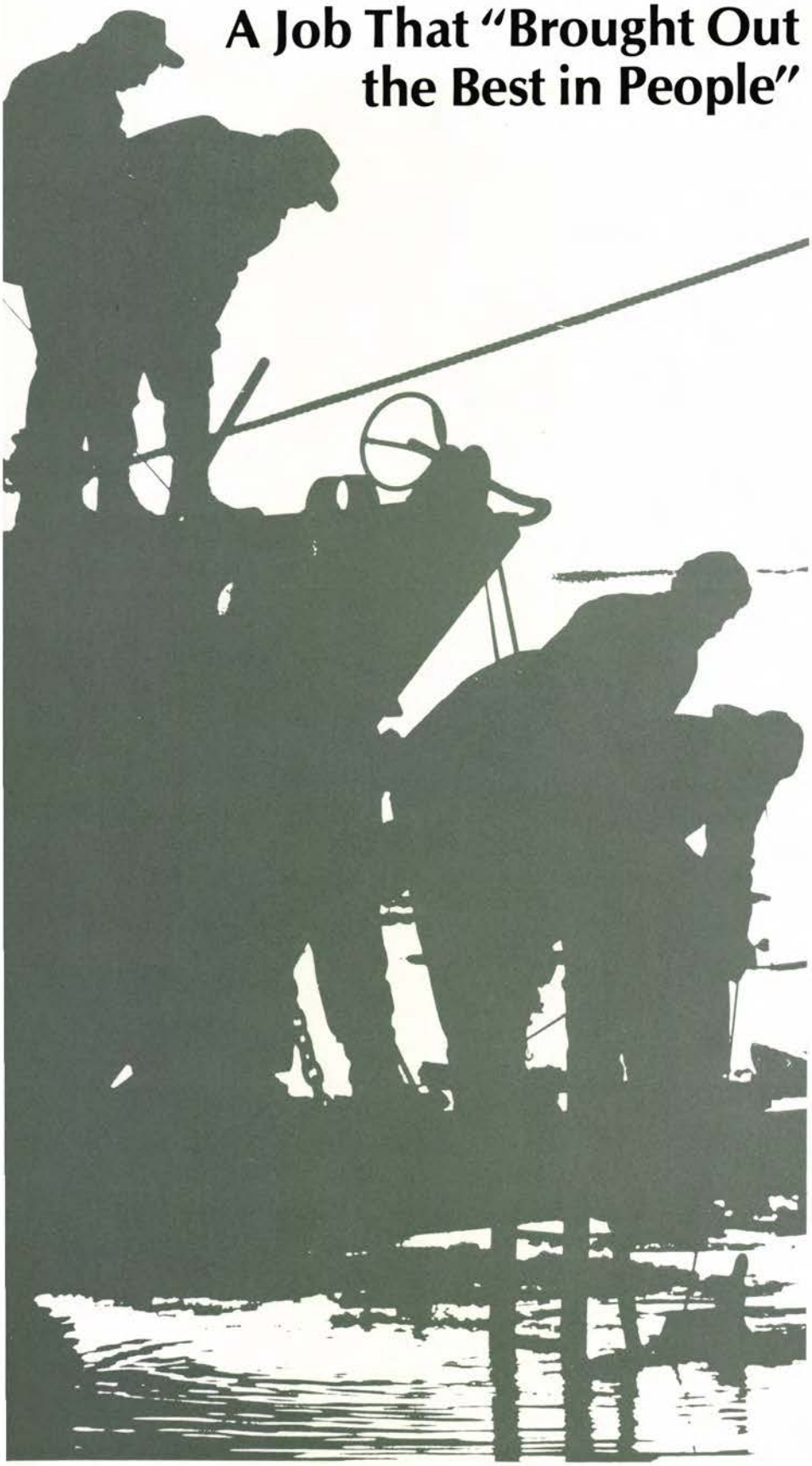
*Above: On January 20, one week after crash, main fuselage was recovered. Flight recorders and cockpit were brought up the same day. By the twelfth day, 95 percent of the wreckage and all of the victims' bodies had been recovered. Below: Dive team from U.S. Army 30th Engineering Battalion, Ft. Belvoir, Virginia.*

**Bittersweet Conclusion**

Operations on January 21 and 22 were very productive and at the commencement of diving operations on Saturday, January 23, about 85 percent of the aircraft had been recovered. There remained but one body to recover; that of a six-month-old infant boy. Considering the odds against recovering all the bodies the results to date were considered phenomenal; yet, with a fervent resolve, the divers began operations intent on achieving the impossible. At 0730, thirty minutes into the first dive, the child's body was recovered. The remainder of the day was spent recovering aircraft

*(Continued on page 30)*

# A Job That "Brought Out the Best in People"



*Story and photos by*
*PH1 Jim Preston, USN*

Wednesday, January 13, had been a fairly routine day in Little Creek, Virginia, for Mobile Diving and Salvage Unit Two (MOBDIVSALU TWO) and its Commanding Officer, LCDR Stephen Delaplane. Heading out the door, LCDR Delaplane remembered that one last call that had to be made. Returning to the quarterdeck, he called his Executive Officer. LT Andrew Hammond answered with a startling statement: "You won't believe what I just heard on the radio. A plane crashed in the Potomac River near Washington National Airport."

LCDR Delaplane rushed to a nearby television room to confirm the news. In a blinding snowstorm, Air Florida Flight 90, a Boeing 737 jet aircraft en route to Tampa, Florida, from Washington, D.C., had struck the northbound span of the 14th Street Bridge after takeoff and plunged into the icy Potomac River.

### Units Mobilize

As the disaster unfolded, LCDR Delaplane put a diving crew on standby and began preparations to deploy a support team, should his unit be tasked.

At 0230, January 14, the call for assistance came.

Meanwhile, members of the Naval School, Explosive Ordnance Disposal (EOD), Indian Head, Maryland, were also being mobilized.

By the afternoon of the day following the crash, LCDR Delaplane had been designated On-Scene Commander of the recovery and salvage operation which would involve divers from his unit, the EOD School, the Coast Guard Atlantic Strike Team from Elizabeth City, North Carolina, and Army divers from the 86th and 511th Engineering Detachments, Fort Belvoir, Virginia.

*Teamwork was exemplary throughout the 12-day operation.*

*(Continued from page 19)*

wreckage and planning the demobilization of an extensive, on-scene support "flotilla".

The operation was officially terminated at 1630, January 25, 1982. In the twelve-day operation, 95 percent of the aircraft, all critical wreckage, and 68 bodies had been recovered. Demobilization was progressing according to schedule, and by 1300, January 27, all that remained as a reminder of the disaster and the subsequent recovery operation were a few snow fences which had been erected as security barriers.

### Under a Microscope

This operation was technically a routine aircraft recovery operation. The extremely cold weather conditions had caused some delays, but hot-water suits, MK 12 dry suits, and Unisuits provided more than adequate diver thermal protection for over 130 dives with up to three-hour bottom times. The fact that the impact area was relatively small, well-defined, and accessible to land cranes expedited the operation.

A unique aspect of this operation was its nationwide visibility. Every salvage operation has its own set of management requirements and in this operation the visibility demanded the quintessence of professionalism, propriety, and sensitivity from every participant. ADM H.D. Traine II, Commander-in-Chief, U.S. Atlantic Fleet, best summarized this aspect of the operation in his comments: "The performance you demonstrated in Washington is a classic example of what we mean by professionalism. Because of the high interest, you all were virtually operating under a microscope . . . and yet you came through with flying colors and you made the entire Navy and the nation proud of you."

*Probing for wreckage in the frozen Potomac River.*

*EOD DET 21 team prepares to explode a charge on the hull to gain access to the ship's interior where crewmen were believed to be trapped.*

*Rescue helicopter from Fleet Composite Squadron 5 (VC-5) during recovery operations.*

initiated it electrically. This attempt failed due to an electrical short in the cable reel. The cable reel was repaired, but darkness prevented continuation of rescue efforts.

During the night, the rescue team assembled to review the situation and plan the next steps. Any attempt to put divers in the water was determined to be extremely dangerous due to rip tides, sheer coral, high waves, and the presence of numerous sharks. It was agreed to concentrate efforts on the above-waterline areas.

### The Final Toll

At dawn, two holes were cut with flex-linear and MK 7 MOD 7 shape charges and the destroyer's interior spaces were inspected. Unfortunately, no survivors were located.

The final casualty toll stood at 49 crewmen dead and 30 missing. Only 18 crewmen had survived.

MOUNT HOOD was relieved in the late afternoon by the Philippine Navy destroyer BATANUAS (PS 74) and proceeded to Manila with the dead. In Manila, RADM Simeon Alejandro, Philippine Navy Flag-Officer-in-Charge, expressed his personal appreciation to Detachment 21 and the officers and crew of MOUNT HOOD for their arduous efforts to recover the casualties of DATU KALANTIAW.

### Rescue Team Personnel

**Detachment 21**

LTJG DeSimone (Officer-in-Charge)
BM1 (DV) Murphy
GMG2 (DV) Lounsbury
BT2 (DV) Maves

**Additional Divers**

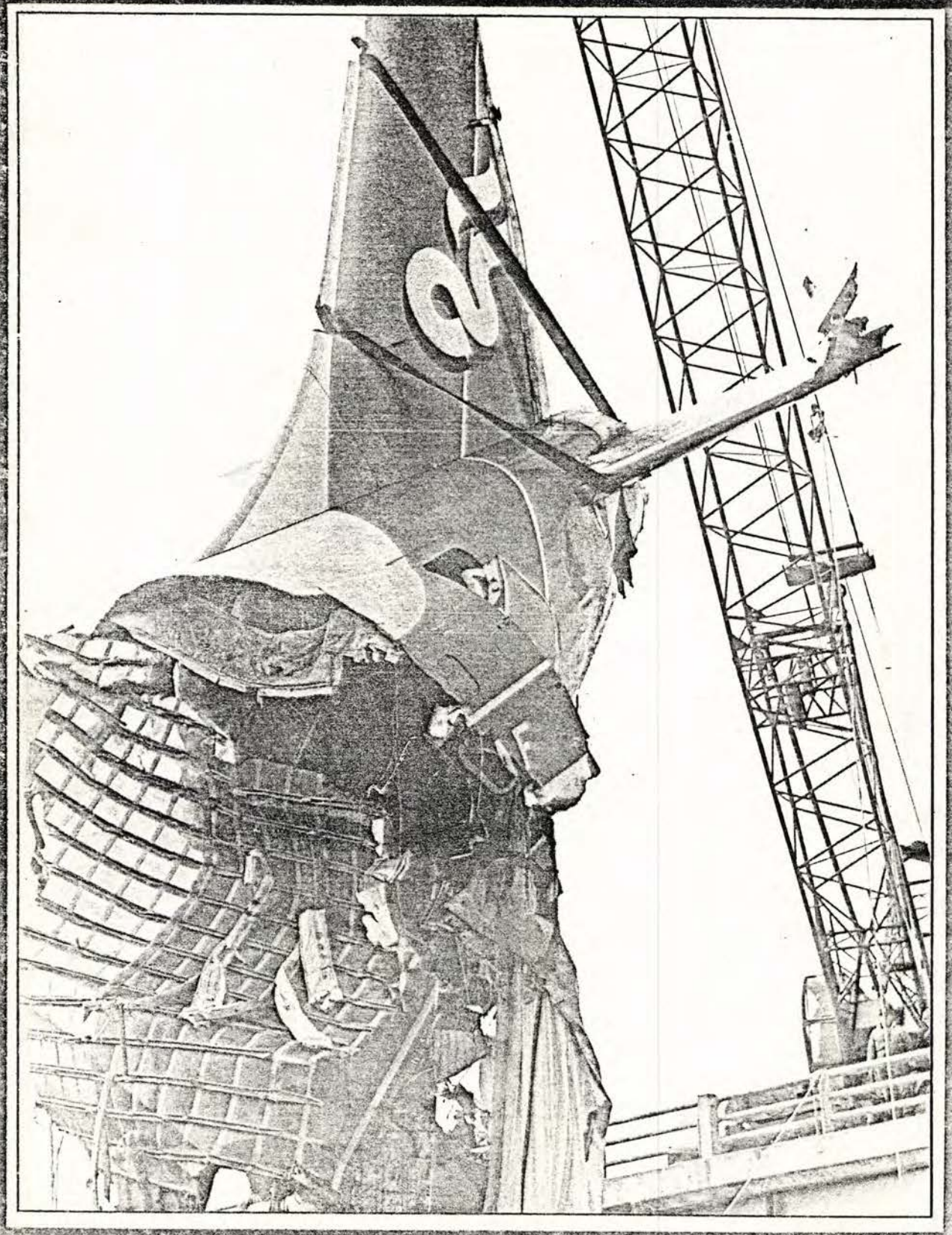
LCDR Boyd (CTF 73 Salvage Officer)
LCDR Steding (SRF Diving Officer)
HT1 (DV) Hettenhouser (SRF)
BM2 (DV) Brigham (SRF)
BM2 (DV) Smoot (SPECWARGRU ONE)
BM3 (DV) Troutman (SPECWARGRU ONE)
HM3 (DV) Hancock (SPECWARGRU ONE)

**Philippine Navy Liaison**

LTJG Austria, RPN

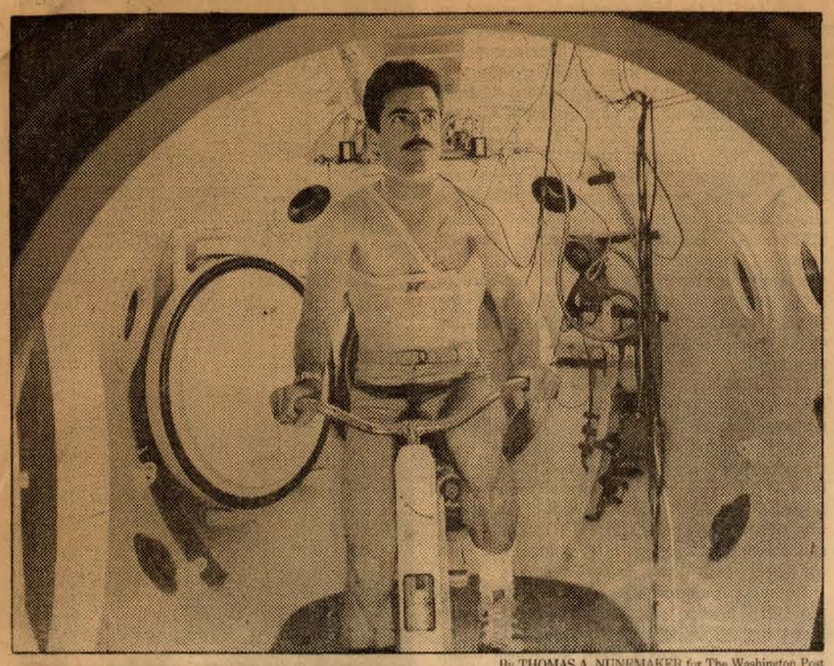
# FACEPLATE

THE OFFICIAL MAGAZINE FOR THE DIVERS AND SALVORS OF THE UNITED STATES NAVY



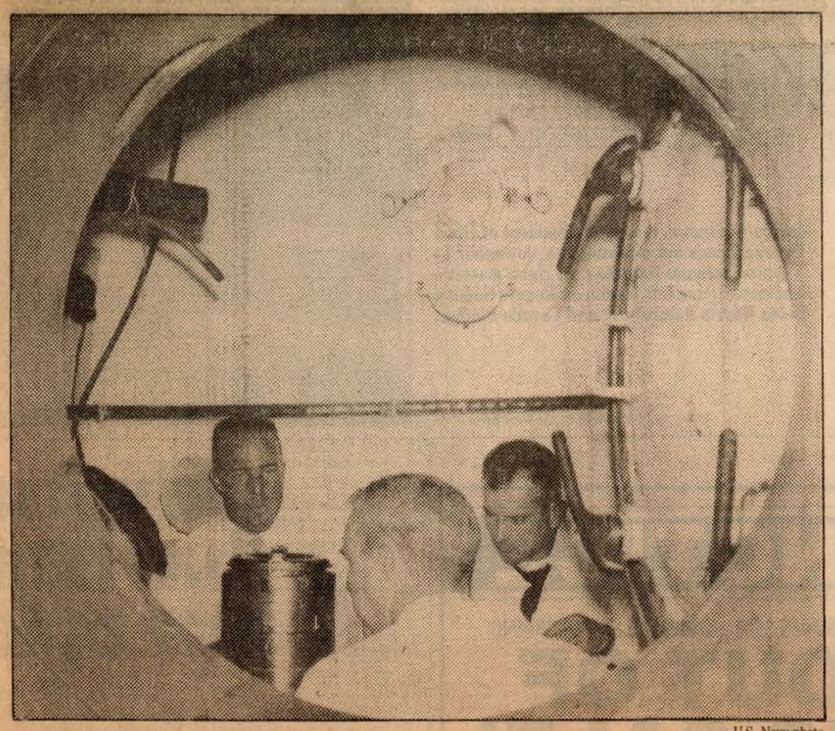
VOLUME 13, NO. 1 □ SPRING 1982

# Naval Institute Takes a Bow at 40



By THOMAS A. NUNEMAKER for The Washington Post

**Navy diver Pete Holden exercises in NMRI hyperbaric chamber to test heart and lung fitness.**



U.S. Navy photo

**June 1959 photo of astronauts Scott Carpenter, left, and Donald Slaton in high-altitude chamber.**

## *Research Center Has Glorious Record, But Faces Fund Cutbacks*

By CRISPIN Y. CAMPBELL
Special to The Washington Post

The Navy Medical Research Institute, where the nation's first astronauts were trained and where research advances include the development of techniques that made sperm banks possible, observed its 40th anniversary Saturday, six months early.

Sources at the Bethesda institute, which opened its doors on Oct. 27, 1942, say one reason for the early celebration was to emphasize, while Congress is considering next year's budget, the harm that funding cutbacks could do to research work.

Navy Commander Vern Schinski, the executive officer, said that while the institute's budget had sufferpd some small cuts, the real problem is that funding has not been increased to keep pace with inflation during the past few years, placing the institute in the position of not being able to keep up with the rising costs of research.

Montgomery County Democratic Rep. Michael D. Barnes told the audience of some 200 naval and civilian well-wishers at an open house Saturday that continued budget cuts and underfunding of research could jeopardize the advances being made at the institute.

"What is the commitment of the United States to the basic research that is done here?" Barnes asked. "Are we going to continue to reduce our research budget and lose our (world) leadership role?"

Barnes said the recently passed Senate budget resolution for fiscal 1983 included an 18-month salary freeze that would affect the institute's 400 employes. He said cuts and reduced funding are "driving the best people out" of government service and added that he plans to fight for a 5 percent raise for institute employes and other government research workers.

Capt. James Vorosmarti Jr., the Navy research facility's commanding officer, said the institute's accomplishments over the last four decades include work on the effects of heat stress on ships, development of protective clothing and development of repellents against sharks and disease-carrying insects, as well as advances in dental and radiation exposure research and tissue preservation.

In the 1950s, the Navy institute became involved in training monkeys, and later human astronauts, for space flight. One of the major advances in this decade was the development of telemetry for transmitting astronauts' physiological data, such as heart rate and blood pressure, from air to ground.

But not every development at the institute was serious. In July 1954, two monkeys, Pete and Repeat, escaped from the labs. According to

See BETHESDA, Page 8, Col. 1

work laid during the five years preceding his leadership the institute moved heavily into research "in the areas of blood preservation, designing the heart-lung machine and methods for fighting decompression illness," or "the bends."

Capt. Henry Wagner, currently a section chief in the National Institute of Neurological and Communicative Disorders and Strokes, led the Navy Medical Research Institute from 1960 to 1965. He said he couldn't isolate a single event. But it was during Wagner's tenure that the institute researched methods to combat typhus, malaria, schistosomiasis and encephalitis, ailments

# Navy Research Center Takes Bow

**Past and present commanders of Navy Medical Research Institute, from left, Capt. Henry Wagner, 1960-65; Capt. Otto Van Der Aue, 1956-60; Capt. James Vorosmarti Jr., present; Capt. Herschel Suddath, 1965-70; and Tor Richter, a retired captain, 1970-74.**

By THOMAS A. NUNEMAKER—The Washington Post

BETHESDA, From Page 1.

printed reports, scientists attempted to incapacitate the monkeys by preparing "a banana loaded with enough dope to knock out a full-grown man." But Pete, "not a grown man," was not affected and subsequently was captured by two 11-year-old boys in Kensington.

There was no account of what happened to Repeat, but the good doctors at the institute reportedly were hunting for him with another banana, "with a different dope guaranteed to knock out a monkey."

Back in the laboratories, freeze-drying techniques were explored as they related to tissue preservation for grafting and other reconstructive surgery.

The institute's tissue bank, which was established during the post-World War II years, still leads the world in the procurement and storage of tissue. During the Vietnam War thousands of wounded soldiers were treated with tissue that was collected, preserved and shipped from the NMRI Tissue Bank. Currently the tissue bank has more than 4,000 collaborators involved in using tissues and continuing research efforts.

Navy medical researchers also have pioneered advances in the treatment of septic shock and shock due to blood loss, development of heart-lung machines, studies of survival and resistance training, and frostbite therapy.

In addition to the 1,000 people who attended the open house, four of the institute's former commanders were on hand for the rain-dampened festivities Saturday. In interviews, they discussed what they thought to be the most significant accomplishment during their tenures.

Capt. Otto Van Der Aue, commander from 1956 to 1960, said that on the basis of groundwork laid during the five years preceding his leadership the institute moved heavily into research "in the areas of blood preservation, designing the heart-lung machine and methods for fighting decompression illness," or "the bends."

Capt. Henry Wagner, currently a section chief in the National Institute of Neurological and Communicative Disorders and Strokes, led the Navy Medical Research Institute from 1960 to 1965. He said he couldn't isolate a single event. But it was during Wagner's tenure that the institute researched methods to combat typhus, malaria, schistosomiasis and encephalitis, ailments common to the tropical areas where the Navy was operating at that time.

Capt. Herschel Suddath, who headed the institute from 1965 to 1970, pinpointed experiments that sought more effective ways to prepare and protect patients on the operating table. The end result was a technique to lower patients' body temperatures for more successful open heart surgery.

THE WASHINGTON POST
Wednesday, May 26, 1982
MD 8

counts. B since the ver and the receiver often do not think alike, a well-meant gift may be received with the warmth the folks in Troy felt for the wooden horse.

A friend of mine received a food processor from her family on Mother's Day. To her family that gift said "labor saver," but to her it said only "labor." A food processor for the food processor, that was the way she saw it. She wanted a sign that her family remembered that she was more than that. She wanted a sign that somebody still saw the black-lace person under the navy blazer or the weekend blue jeans.

Sometimes a present sends a message that self-improvement is in order.

Jogging shoes may be a terrific birthday gift, but the friend who received them didn't think so. She isn't a jogger. Those shoes did start one person running for his life—the husband who bought them.

Self-improvement presents for men often include articles of clothing that suggest it is time to change images. A man who goes through life in shades of gray will receive a red sports shirt; a weekend lumberjack will be given a pair of white flannels more suitable for the yacht club than Yosemite. The unwritten rule is that the offending gift must be worn at least once, even if your face is as scarlet as the shirt during the wearing. Then the item can vanish mysteriously into the closet or chest.

All of the burdens are not on the receiving end. Givers are faced with impossible decisions: what to buy for the occasion that demands a gift that is personal yet practical, creative yet constructive, and bolsters the relationship but does not break the bank. Unhappily, what the recipients really need—love, health and happiness—you cannot buy for them and what you *can* buy, they don't need.

How do we know when we fail to find the right gift? One hint is the thank you note which refers to the sterling silver candle snuffer in such vague terms it is clear the giftee had no idea what to do with it. Another indication is when the perfume atomizer you sent your favorite aunt is unwittingly presented to you the following year.

The only solution to the dilemma over presents is preparation—not inspiration. Telling each other what we would like as gifts and shopping together for them makes sense at a time when few people have the time and money to spend for things nobody wants or needs.

I believe in the Holiday Inn philosophy of gift-giving: the best surprise is no surprise. It would be easier for our loved ones to find out what is in our hearts than to read our minds.

8 percent of the 1,125 undergraduates are men.

Tidball is a graduate of Mount Holyoke College, a women's college in Massachusetts, and a member of Hood's board of trustees. One of the most important advantages of women's colleges, Tidball said, is the high percentage of women on their faculties. Not only do women professors make excellent role models for female students, she said, but they are "more affirming than men faculty of women students as persons—of their goals and aspirations and of a variety of women-related issues."

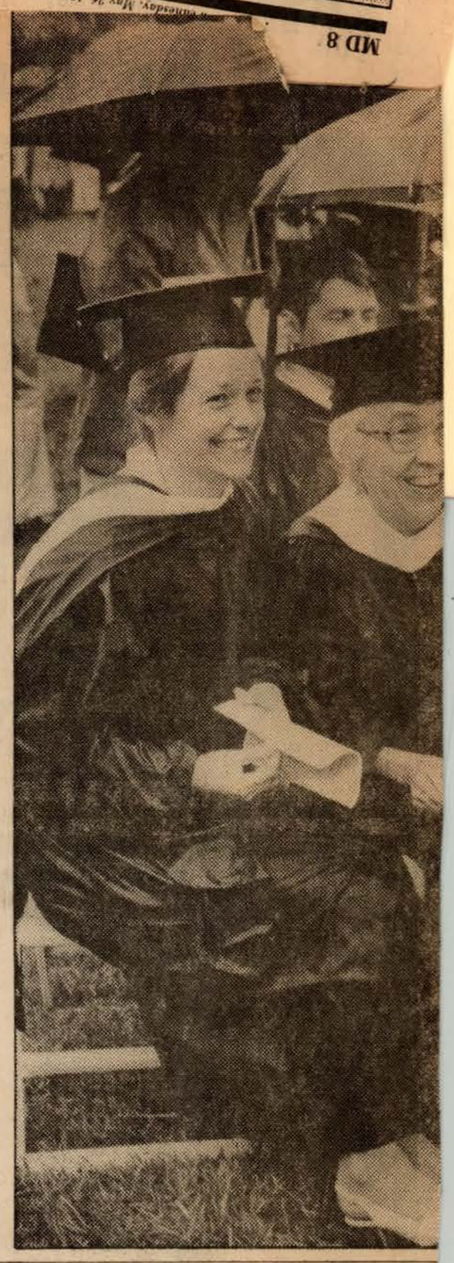
What's more, she said, thecurriculum is structured with women in mind, and the atmosphere that is created encourages better relationships among women than would occur at coeducational institutions. "Because relationships between women in this environmental setting are not daily and everywhere interrupted by the presence of large numbers of men students," she said, the young women are "freed from the cross-pressures of two conflicting behavioral modes: the behaviors appropriate to the establishment of friendships with other women and the more sexually colored behaviors appropriate for the establishment of relations with men."

But the graduating students at Saturday's commencement seemed more concerned with the rain than with relationships with men or women. "I'm soaked to the skin," said Julia Ball of Annapolis, who received a bachelor's degree in interior design and posed for snapshots, in dripping gown, with her friend Susan Wyda, also of Annapolis.

Elizabeth Anderson, who received a BA in history with honors, was "half-drenched," having shared her umberella with two classmates.

Anderson, 56, owns a dairy farm near Camp David. Her 26-year-old son is a junior at Hood and also works on the farm.

Bachelor's degrees were conferred on 280 students, ages 58 to 21, including 53 "continuing education" students who are all over 25. Eight of them were men. Master's degrees were conferred on 68 women and 24 men.



**Martha E. Church, top right, president of Hood College, hands out diplomas in a downpour at commencement Saturday. At right: master's candidates, from left, Kathleen Rogers Senuta, Helen Harris Rambsburg and Carolle Plotner.**

Photos by RAY LUSTIG—The Washington Post